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Education for Healthcare Providers, Nurses, and the Public on Opioid Induced Hyperalgesia

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OPIOID INDUCED HYPERALGESIA EDUCATION FOR PATIENTS, NURSES, AND PROVIDERS

A Scholarly Project Submitted to the Graduate School in Partial Fulfillment of the Requirements for the Degree of Doctor of Nursing Practice

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EDUCATION FOR HEALTHCARE PROVIDERS, NURSES, AND THE PUBLIC ON OPIOID INDUCED HYPERALGESIA

An Abstract of the Scholarly Project by
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This project evaluated the knowledge of the public, healthcare providers, and nurses regarding opioid induced hyperalgesia (OIH). OIH is an elevated pain response because of high dosage or chronic use of opioids. Opioids are a problem not only in the United States but throughout the world; addiction, constipation, and overdose are the most frequently mentioned consequences of opioids. Little is known about other consequences to the body caused by chronic or high dose opioid usage, such as OIH. This project sought to increase awareness and caution against the utilization of opioids by patients and their healthcare providers and nurses practice. Two healthcare providers and nurses' education sessions were held via Zoom meetings with the material presented based on results from a Facebook survey that was used to assess current knowledge. Pre- and post-session surveys were given to healthcare providers and nurses to evaluate their education and current and future practices. Upon evaluation of the data, it showed that over half the participants were unable to correctly define OIH, that the majority were nurse practitioners in the clinic, and back pain was the most frequent reason for opioids utilized in their practice, with Tramadol being the biggest culprit. Post-session surveys displayed a decrease in the number of healthcare providers and nurses that would utilize opioids for back pain.

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CHAPTER I

Introduction/Purpose

Description of the Clinical Problem

Opioid induced hyperalgesia (OIH) is "the increased sensitivity to painful stimuli as a result of opioid use" (Hayhurst & Durieux, 2015, p. 485). This phenomenon has been discussed for over 100 years; however, there has been little research previously to understand it. The number of patients who are exposed to opioids is increasing, potentially making the prevalence of OIH increase proportionally.

Many patients are opioid naïve until their first surgery or injury, when they receive the first opioid. The rate of opioid prescriptions has steadily risen since the 1990s due to pharmaceutical companies assuring providers their patients would not become addicted (National Institute of Health, 2018, para 2). According to the Centers for Disease Control (CDC), the rate of opioid prescriptions began to climb when opioids were prescribed for chronic nonmalignant pain in the 1990s. As time progressed, the amount of opioids prescribed and number of opioids given escalated. According to the CDC, "in 2015 the amount of morphine milligram equivalents (MME) was three times higher than what it was in 1999" (CDC, 2017). This has caused overall access to opioids to increase regardless of legality.

There are several different receptors opioids interact with which are called pain receptors or nociceptors. The major types of pain receptors are "mu (μ), kappa (κ), delta (δ), and an opioid-like receptor called nociceptin or orphanin FQ peptide" (Adams, Holland, & Urban, 2017, p. 242). Each opioid will target a specific receptor, which in turn sends signals to the brain, and the interpretation is pain relief. Opioids act mainly on the μ opioid receptor (MOR), which inhibits neuronal pathways in the central nervous system (Bannister, 2015, p. 117). If this inhibition is repeated too often, as with chronic opioid use, the over-inhibition may cause the body to overrespond to pain stimulus. This heightened response to pain does not necessarily lead to escalating opioid dosages but may continue to worsen as more opioids are administered. As a result of the increased opioid dosages, patients are more likely to experience opioid addiction, tolerance, and adverse drug events including overdose.

Significance to Nursing

Pain control, with or without opioids, is an important aspect of everyone's life. Pain inhibits a patient's activity, quality of life, and their health and/or longevity. There are multiple methods utilized to treat pain, with opioids being a method that has increased in usage over the past few decades. Ongoing research has improved opioids and discovered new ones, as well as provided alternative means of analgesia which also are being improved.

Healthcare providers and patients are experiencing an opioid crisis both directly and indirectly. The number of opioids has steadily increased, both in drugs discovered and prescriptions given, since the 1990s, creating an increased risk of OIH, addiction, tolerance, abuse, and death. OIH may occur secondarily to long term opioid use, or may

occur with the initial exposure of high doses, such as during the perioperative period. Some opioids, and certain MME, are noted to have an increased probability of causing OIH making pain control more difficult.

As pain control becomes more difficult at lower doses, opioid dosages are being increased until either the patient has relief or until they require an opioid antagonist, such as naloxone or Narcan. When naloxone is administered in the hospital, it is tracked as an adverse drug event, and is monitored for its frequency. Several areas have legislation regarding the sale of naloxone and Narcan to people without a prescription and coverage to those who administer it in good faith to a potential opioid overdose victim found outside of the healthcare setting. Escalating doses of opioids to control pain and the ease of access have created the perfect storm for people to overdose. Patients who suffer from OIH will need higher doses of opioids prior to noted analgesia, potentially setting the stage for life-threatening adverse drug reactions such as respiratory arrest or depression. At that moment, the patient will need naloxone administered to stay alive. People having access to opioids outside of the hospital will have the same problem; however, they may not receive the naloxone fast enough to save their lives.

As the number of available opioids has increased, patients are more dependent on their use for pain, with some patients expecting opioids when they see their healthcare provider for acute or chronic pain. The potential for opioid prescription misuse has increased due to ease of access, and it has become costly. The estimation for treating prescription opioid misuse alone in the United States is $78.5 billion a year “including the costs of healthcare, lost productivity, addiction treatment, and criminal justice involvement” (National Institute of Health, 2018, para 1). The Doctor of Nursing (DNP)

prepared nurse practitioner will be accountable for their treatment of people seeking treatment for pain and other ailments, and educating others, including colleagues, about the risks associated with opioids including OIH.

Purpose

The purpose of this project was to educate healthcare providers and the public about OIH. The focus of education was about the causes of OIH, any predisposing factors, how to treat patients with OIH, preventative methods, and alternative analgesia to recommend or implement for all levels and groups. It was hypothesized that better education will facilitate more preventative programs and care for the public, resulting in fewer cases of OIH.

Theoretical Framework

Martha Rogers' Theory of Unitary Human Beings was selected for this project due to the approach Rogerian nursing has focused on. Rogers integrated different areas of a person's life and environment into the care of that person and also looked at nursing as a science. Rogers felt that "research in nursing must examine unitary human beings as integral with their environment" (Alligood, 2014, p. 227). The person is constantly interacting with other people, their environment, and making decisions based on those interactions. The inclusion of the following human and environmental fields is essential for this project:

> sharing knowledge; offering choices; empowering the patient; fostering patterning; evaluation; repeat pattern appraisal which includes nutrition, work/leisure activities, wake/sleep cycles, relationships, pain, and fear/hopes;

identify dissonance and harmony; validate appraisal with the patient; and self-reflection for the patient (Petiprin, 2016).

These fields not only interact with each other but also have the potential to feed off one another. Rogers believed that people are capable to participate in the change process.

People will share information, regardless of its credibility, with others who will evaluate and make decisions based on that information. This information might range from how to prepare a specific food to how to alleviate their pain with or without opioids. This misinformation has the potential to cause poor perceptions of offered choices and therefore lead to poor choices. Any alteration in a person's personal life will also affect their decision making, and, at times, make them feel as if they have no power over their life. As a result, they will make choices which allow them to feel like they finally have power over their life but, have done more harm than good. The harmful choices have then led to a decline in their overall health.

Healthcare providers must remember to evaluate all aspects of their patient's life in order to properly educate their patient. If the patient does not understand, or is unwilling to comply with treatment after education, then the provider will have diverted their efforts from another patient with no gain made for either side. If there is something in the patient's life negatively affecting the human or environmental field, such as poor nutrition or altered wake/sleep cycles, which the provider does not account for then the patient will not be able to focus during the education much less comprehend it.

Patients must be cognizant of how all aspects in their life will have an influence on the whole, including comprehending education. Patients may not realize how something very small, like the sharing of and receiving poor information that seems

credible, will significantly and negatively impact their lives. Even influence from others will affect the patient's interpretation of any educational information regarding their health and plan of care.

The information provided in this project for healthcare providers and the public examines the interaction between all aspects of the person's life. It takes into account that people will have other factors influencing their lives, which could potentially negatively impact their health. If all factors are not assessed, it will be difficult for a person to not only make any necessary changes but receive, interpret, and implement appropriate changes in their lives. Additionally, if the healthcare providers are not cognizant of their patients' barriers to optimizing health, it will not matter what treatment is recommended because the patient will be unable or unwilling to comply.

Project Questions

1. Could healthcare providers and nurses define OIH before receiving education on OIH?
2. What was the current practice among healthcare providers and nurses regarding OIH and opioids before receiving education on OIH?
3. What were the beliefs and attitudes among healthcare providers and nurses regarding OIH and opioids before receiving education on OIH?
4. Were healthcare providers and nurses comfortable communicating with patients about pain management before receiving education on OIH?
5. What was the current practice among healthcare providers and nurses regarding OIH and opioids after receiving education on OIH?

6. What were the beliefs and attitudes among healthcare providers and nurses regarding OIH and opioids after receiving education on OIH?
7. Were healthcare providers and nurses comfortable communicating with patients about pain management after receiving education on OIH?
8. Could patients define OIH before receiving education on OIH?
9. What were patients' attitudes and beliefs about opioids and OIH prior to receiving education on OIH?
10. What was the reported use of opioids by patients before receiving education on OIH?
11. What were patients' attitudes and beliefs about opioids and OIH after receiving education on OIH?
12. What was the reported intended use of opioids by patients after receiving education on OIH?

Definition of Key Terms/Variables

1. Opioid induced hyperalgesia (OIH) – "the increased sensitivity to painful stimuli as a result of opioid use" (Hayhurst & Durieux, 2015, p. 485)
2. Nociceptor – receptors that receive stimuli that "cause, or could potentially cause, tissue damage" which is interpreted as pain (Widmaier, Raff, & Strang, 2014, p. 204)
3. Opioid – medications that "bind to opioid receptors in the central nervous system with analgesic effect primarily associated with μ-receptor binding" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 102)

4. Morphine milligram equivalent (MME) – tool used in prescribing opioids that converts the opioids into a similar unit that prescriptions are based on (Pino & Covington, 2018)
5. Healthcare professional – a person that assists with illness prevention, identification, or treatment (Farlex, 2012). Any person who has a license to prescribe, dispense, or administer opioid medications.
    a) Physician (MD or DO) – person who is licensed and trained to practice medicine; they are either a Doctor of Medicine or a Doctor of Osteopathic Medicine (American Heritage of the English Language, 2016c)
    b) Physician assistant (PA) – person who has trained to "provide a variety of medical services" and is under the supervision of a physician (American Heritage Dictionary of the English language, 2016a)
    c) Advance practice registered nurse – a registered nurse who has completed additional training regarding diagnosing and treating diseases (National Cancer Institute, n.d.)
    d) Nurse – person who has received training specialized in caring for other people under the care of a healthcare provider such as a physician (Farlex, 2012)
    e) Pharmacist – person who is licensed to dispense medications to patients as per written or electronic prescription
6. Patient – someone who is receiving care and/or treatment for a condition from a physician or surgeon (Merriam-Webster Incorporated, 2018)
7. Alternative analgesia – pain relief that does not involve opioids
8. Adverse drug event – event involving medication(s) which have impacted a patient negatively by causing harm; can happen anywhere and includes "medication errors, adverse drug reactions, allergic reactions, and overdoses" (Office of Disease Prevention and Health Promotion, 2018)
9. antagonist – "drugs that display an affinity and do not elicit a response"; can bind to the receptor but block the action of the endogenous agonist's activity (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 29)

10. N-Methyl-D-Aspartate Receptor (NMDA) antagonists – medication that "reduces firing of the NMDA receptor therefore sensitivity to pain impulses" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 108)
11. Nonsteroidal anti-inflammatory drug (NSAID) – medication class which "have anti-inflammatory, analgesic, and antipyretic activity" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 102)
12. agonist – "drugs that display a degree of affinity for a receptor and stimulate a response" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 29)
13. α_2 adrenergic agonist – "stimulate α_2 adrenergic receptors in the brain, resulting in decreased sympathetic outflow, cardiac output, and peripheral resistance" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 268)
14. chronic opioid use – opioid taken for longer than 90 days (Thornton, et al., 2018)
15. acute opioid use – opioids taken for less than 90 days (Thornton, et al., 2018)
16. intravenous – route of medication given through a catheter inserted into a vein
17. oral – route of medication that is taken by mouth
18. perioperative – surgical timeframe that begins when the patient is admitted for the surgical procedure (Whitlock, 2018)
19. Intraoperative – timeframe in which the surgical procedure is taking place (Whitlock, 2018)
20. Postoperative – timeframe after the surgery has taken place
21. Centralized pain – "any pain that happens when the central nervous system doesn't process pain signals properly" (Arthritis Foundation, n.d.)

Logic Model of the Proposed DNP Project

This project utilized different resources to complete this project and are illustrated in the logic model figure 1. The items were placed in the chart by level of importance. Education resources were felt to be the most important factor for input because everything else is dependent on whether the funds, time, and personnel are available for education intervention. The strategies are OIH education to healthcare providers, patients, social media for respondents, and education site(s). Another consideration was email; however, it was not believed to be a good use of resources to send mass emails to random email addresses, hoping to receive the appropriate number of responses from healthcare providers and the public. The healthcare provider location was felt to be most important output since the primary focus will be the Southeast Kansas area, with some focus on Southwest Missouri. Patient location was also of higher importance since the target area is primarily Southeast Kansas. The type of education delivered to both groups and revaluations were similar in importance. The outcomes were to see an increase in alternative analgesia recommended by providers, a decrease in opioid prescriptions for the target area, decreased use of naloxone in the hospitals and for first responders in the target area, verbalization for the public what realistic pain expectations are and their understanding of usage of alternative analgesia. The assumptions were that healthcare providers will not have a bias towards OIH; the public would be honest in answering survey questions about opioids, OIH, and alternative analgesia knowledge; educational material regarding OIH, opioids, and alternative analgesia would be read; comprehension of educational material by healthcare providers and the public; honest efforts by healthcare providers to decrease opioid use and increase

alternative analgesia; and honest efforts by the public to decrease their opioid use and increase their use of alternative analgesia. External factors affecting this project were the cost of printing educational material for healthcare providers and the public; bias by healthcare providers towards patients taking opioids regardless of chronically or acutely; attitudes by the public regarding why they should not expect to receive opioids for pain control; attitudes by the public and healthcare providers regarding use of alternative analgesia; access to the survey by healthcare providers and the public; internet access available for healthcare providers and the public; and time constraints for healthcare providers and the public to complete both the pre- and post- educational material survey. The evaluation of the intervention was checking for an increase in knowledge regarding OIH, opioid awareness, and alternative analgesia shown on the post educational survey for both healthcare providers and the public.

Figure 1: Project logic model

NAME OF PROJECT			
Opioid Induced Hyperalgesia Education for Patients and Healthcare Providers			
INPUT	**STRATEGIES**	**OUTPUT**	**OUTCOMES**
Education resources Surveys Materials Training material Time educating Educator	OIH education Healthcare provider Patients Social media for respondents Education site(s)	Healthcare provider location Patient location in Kansas/Missouri Type of education delivered Revaluations	Increase in alternative analgesia recommended by providers Decreased opioid prescriptions Decreased use of naloxone in the hospital and first responders Verbalization from public what realistic pain expectations are and usage of alternative analgesia
ASSUMPTIONS		**EXTERNAL FACTORS**	
1. Healthcare providers would not have bias towards OIH 2. The public was honest in answering survey questions about opioids, OIH, and alternative analgesia knowledge 3. Educational material regarding OIH, opioids, and alternative analgesia would be read 4. Comprehension of educational material by healthcare providers and the public 5. Honest efforts by healthcare providers to decrease opioid use and increase alternative analgesia 6. Honest efforts by the public in decreasing opioid use and increasing alternative analgesia		1. Cost of printing educational material for healthcare providers and the public 2. Bias by healthcare providers towards patients taking opioids regardless of chronically or acutely 3. Attitudes by the public regarding why they should not expect to receive opioids for pain control 4. Attitude by the public and healthcare providers regarding use of alternative analgesia 5. Access to survey by healthcare providers and the public 6. Internet access for healthcare providers and the public 7. Time constraints for healthcare providers and the public to complete both the pre and post educational material survey	
EVALUATION PLAN			
There will be an increase in knowledge regarding OIH, opioid awareness, and alternative analgesia shown on the post educational survey.			

Summary of Chapter

The opioid crisis is a significant problem which includes the frequency of OIH. As a condition, OIH is not discussed much separately from tolerance, and some healthcare providers feel that the two conditions are one. As the incidence of opioid prescriptions increased since the 1990s, the risk of developing OIH has proportionally increased. Proper education of healthcare providers would assist in decreasing the frequency of opioid prescriptions, decreasing the use of opioids with increasing the use of alternative analgesia, and a better understanding of the risks and benefits of opioids and alternative analgesia. Education of patients would facilitate a decrease in the amount of opioids consumed and an increase in the use of alternative analgesia.

CHAPTER II

Review of Relevant Literature and Evidence

Relevant literature was found via searches in Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and Google Scholar. Terms searched were opioid induced hyperalgesia, hyperalgesia, hyperalgesia pathophysiology, alternative analgesics, and OIH education. There were few published studies regarding OIH education, so the term was changed to hyperalgesia and provider education. This change resulted in more material; however, it was primarily education material for continuing education credits and not studies. Further attempts were made to find published studies on OIH education, including use of the resource librarian; however, the attempts continued to yield very little information. It was decided the education literature needed to focus on education about opioid prescribing for providers because of the current nationwide focus on the opioid crisis and the large number of patients currently taking opioids in the United States. The articles were limited to within the past five years of peer-reviewed or scholarly journals for both nursing and medical fields.

The review of literature was broken down into three segments: OIH pathophysiology, alternative analgesics, and education for and about the opioid prescribing practices of providers. OIH pathophysiology was further broken down into the following categories: medications found to be frequently associated with OIH,

chronic opioid use and OIH, and physiology of receptors in OIH. The following is the review of literature.

OIH Pathophysiology

There are certain opioid medications which have been shown to cause hyperalgesia in patients, and there are others that may cause hyperalgesia that are currently being studied. Chronic opioid use, even with small amounts of MME, has been recognized as a risk factor for developing OIH in both clinical and surgical settings. Research continues to attempt to identify the specific pathophysiology behind OIH, but it is currently thought to be related to the N-methyl-D-aspartate (NMDA) and μ-opioid receptors, since deregulation or inhibition of these receptors decreases the hyperalgesia effects of medications.

Medications Found to Be Frequently Associated with OIH

Certain opioids have been noted to cause hyperalgesia with high doses. These medications are given at different times to patients and the doses do affect how well the patient does. Remifentanil is one such medication; however, in the United States it is not frequently used. Remifentanil has recently been approved by the FDA to be given sublingual for extreme pain when intravenous access is not attainable. Koo et al. (2017) evaluated whether utilizing naloxone could reverse some of the side effects of opioids for patients having an elective thyroid surgery. There were 91 patients total in the study, 31 patients were in the high-remifentanil group and 30 were in the low-remifentanil group, and 30 were in the high-remifentanil with naloxone group. The opioid in question for this study was remifentanil, which other studies have found to cause OIH with high doses. One mechanism believed to be behind hyperalgesia is that the NMDA or the μ-

opioid receptors are either upregulated or altered, but this has not yet been confirmed (Koo, et al., 2017). The naloxone and remifentanil combination had been utilized with animal studies; however, it had yet to be tried with humans prior to Koo et al. (2017). The researchers utilized naloxone to counter some of the effects of remifentanil with the anticipation that the incidence of remifentanil-induced OIH would decrease. It was found that when low dose naloxone was added to the high dose remifentanil during anesthesia it "significantly reduced postoperative hyperalgesia on the peri-incisional area compared with using remifentanil alone" (Koo et al., 2017, p. 1165). A drawback with utilizing naloxone with an opioid, such as remifentanil, is that there will be a decrease in the effects of the analgesic effect of the opioid causing a reduction in pain relief.

Opioids, such as morphine and fentanyl, are utilized every day for pain relief in acute, operative, and chronic pain. Intraoperative pain control consists of the use of morphine, fentanyl, or remifentanil which, if used at higher doses, can cause hyperalgesia in patients. Yildirim et al. (2014) discussed how the higher doses of fentanyl intraoperatively causes hyperalgesia in patients who had coronary artery bypass graft surgery. A total of 100 patients were randomly assigned to either the low-dose (2mcg/kg) or high-dose (40-70mcg/kg) fentanyl anesthesia groups for elective coronary artery bypass graft surgery with each group having 50 patients (Yildirim et al., 2014). The patients received pre-operative education regarding the pain scale that was utilized to assess their pain in addition to the patient-controlled analgesia pump. The patients who had received higher doses of fentanyl had increased pain that was difficult to control without escalating the dose of ordered postoperative opioids, 8126.0 ± 725.9 mcg versus 883.6 ± 74.0 mcg fentanyl (Yildirim et al., 2014, p. 3430). This effect is sometimes

mistaken as tolerance, but "the loss of analgesic efficacy can also be the result of opioid-induced hyperalgesia" (Yildirim, et al., 2014, p. 3432). Joly et al., (2005) sought to prove that high doses of remifentanil would induce hyperalgesia but also show that small doses of ketamine given during the surgical case would prevent hyperalgesia. All participants underwent open colorectal surgery lasting at least two hours (Joly et al., 2005, p. 148). Three groups were utilized in the study: small-dose (0.05µg/kg/min), large-dose (0.4 µg/kg/min) remifentanil, and large-dose (µg/kg/min) and ketamine. Joly et al. (2005) found that the large dose of remifentanil patients required post-operative morphine faster than the small dose remifentanil and large dose remifentanil with small dose ketamine, 24 minutes versus 35 and 41 minutes, respectively. They also had higher cumulative morphine requirements through the first 48 hours, 86 mg versus 68 mg and 62 mg respectively. As a result, the researchers concluded that low dose ketamine given with high doses of remifentanil would prevent postoperative OIH caused by remifentanil. Yildirim et al. (2014) noted that the hyperalgesia seen in the high dose fentanyl patients disappeared in roughly one week post operatively.

Mauermann et al. (2016) also looked at fentanyl and OIH. The study utilized 21 healthy volunteers who were given low (1µg/kg) and high (10 µg/kg) doses of fentanyl at different times and their pain tolerance to cold and electrical stimulation were tested hours after the dose completion (Mauermann et al., 2016). Because there was concern the two fentanyl doses would influence each other, Mauermann et al. (2016) chose a period of three weeks between studies to allow the fentanyl to have "washed out" of the volunteers' systems. Mauermann et al. (2016) confirmed high doses of fentanyl would create hyperalgesia even in healthy volunteers.

Chronic Opioid Use

Patients receive opioids, along with other medications, to treat arthritis-type pain prior to orthopedic surgery; because of this, they may be at risk of developing OIH. However, this had not been frequently tested in humans, but it was observed in animals (Hina, Fletcher, Poindessous-Jazet, & Martinez, 2015). Hina et al. (2015) sought to evaluate not only OIH in patients routinely taking opioids pre-operatively but to assess pain level and morphine consumption of patients post-operatively. Hina et al. (2015) asked 68 patients what opioids they were taking, the doses and daily frequency taken, and how long they had been on the opioids. After this was obtained, the opioids were converted to "morphine sulphate equivalents as follows: 1mg morphine = 0.5 mg oxycodone = 6mg codeine = 5mg tramadol" (Hina et al., 2015, p. 256). While Hina et al. (2015) included patients on strong opioids, most of their patients were taking weaker opioids such as tramadol, confirming other recent studies findings.

While opioid prescriptions have increased, few studies have evaluated the risk of patients developing OIH after long-term opioid use. OIH frequency is increasing and is a type of "altered central pain processing" but there has not been a set diagnostic criteria developed to identify "the presence of centralized pain" (Wasserman, Brummett, Goesling, Tsodikov, & Hassett, 2014, p. 14). Wasserman et al. (2014) hypothesized that despite opioid therapy, those with persistently high pain complaints would present with characteristics seen with centralized pain compared to their counterparts reporting low levels of pain. What they discovered was 49.1% of the 582 patients on chronic opioids were still reporting higher amounts of pain compared to those with lower scores (Wasserman et al., 2014). Wasserman et al. (2014) could not determine the exact reason

for this from utilizing the self-reported pain scale (0 = no pain and 10 = pain as bad as you can imagine). Further analysis by Wasserman et al. (2014) concluded that potential causes for the continued high levels of pain were from insufficient analgesics, recently started opioid therapy, OIH, a product of the initial pain issue, or a combination of any of these. Wasserman et al. (2014) did suggest that patients having centralized pain after starting opioids or as a result of the primary condition causing the pain would benefit from weaning off opioids with transition to non-opioid medications. Additionally, further studies are warranted to determine the cause of this phenomenon. Wasserman et al. (2015) wanted to determine if there was an assessment that could be utlized that would detect hyperalgesia for those with suspected OIH. Their study consisted of people who had been presumed to have OIH who were referred to a clinic for opioid cessation or transition to buprenorphine compared to healthy, opioid naïve counterparts. Additional information they sought to examine was hyperalgesia after fentanyl (1.5 µg/kg) was given intravenously (Wasserman et al., 2015, p 689). What Wasserman et al. (2015) found was that the group who were on chronic opioids, those taking more than 100 MME, reported higher pain levels than the opioid naïve group. The higher the dose of chronic opioids, the lower the pain tolerance and males chronically on opioids who received a placebo prior to the fentanyl displayed an increased pain sensitivity with pressure pain indicative of hyperalgesia. Wasserman et al. (2015) noted they found that those taking higher doses of opioids displayed a lower pain tolerance; however, they were unable to find a difference between the healthy opioid naïve and chronic opioid groups in the measures of evoked pain. Their findings further emphasized that chronic opioid use, especially higher MME doses, could cause patients to develop OIH.

Osteoarthritis is a common disease for which opioids are prescribed after other attempts of adequate analgesia have not been successful. Pivec et al. (2014) sought to compare patients who were chronically taking opioids and those who were opioid naïve having a total hip arthroplasty (THA). They compared five criteria:

1. Consumption of narcotics immediately after surgery
2. Continued narcotic uses at the six-week post-operative visit and at approximately five-year follow-up
3. Length of hospital or rehabilitation stay
4. Harris hip score
5. Radiographic outcomes (Pivec et al., 2014).

Pivec et al. (2014) converted oral and intravenous opioids to morphine equivalent doses and the fentanyl patches were converted to morphine equivalent doses by taking the mean of the values found in the American Pain Society's literature from 2003 regarding acute and cancer pain treatment. Pivec et al. (2014) noted that propoxyphene was no longer available in the United States at the time of their study. Pivec et al. (2014) showed that patients who were taking opioids prior to their THA not only needed higher amounts of opioids post-operatively, 275 MME versus 175 MME, but they had longer hospital stays, 4 days versus 3 days, and/or worse clinical outcomes. They also had a Harris hip score of 84 points versus 91 points. There were 81% of the patients taking opioids prior to surgery who could taper off their opioids (Pivec et al., 2014, p. 1163). An additional finding was that those taking chronic opioids had a higher likelihood of having an underlying psychiatric condition compared to others and had lower post-operative clinical

scores (Pivec et al., 2014). Pivec et al. (2014) provided more evidence for increased chances of OIH with chronic opioid use.

Physiology of Receptors in OIH

A potential mechanism discussed in Koo et al. (2017) is the upregulation or alteration of NMDA or μ-opioid receptors that causes the hyperalgesia patients experience. Koo et al. (2017) believed this mechanism was identified when they used naloxone with remifentanil, a μ-opioid agonist, in their study since naloxone can reverse the effects of opioids. Naloxone reverses the effects of opioids due to its antagonistic properties to μ and κ receptors and how opioids act on μ and κ receptors (Adams, Holland, & Urban, 2017, p. 243). Koo et al. (2017) did not further investigate the mechanisms behind the receptors as it was not a goal of their study. Linnstaedt et al. (2015) hypothesized that a genetic variation with the μ-opioid receptor A118G allele, specifically the AG or GG genotype, would have decreased pain and felt when this characteristic should be most pronounced in was women within six weeks of the motor vehicle collision. Linnstaedt et al. (2015) expected that those who had one or more G alleles at A118G would not be as likely to develop hyperalgesia post-stress exposure. While they found most women did not develop hyperalgesia, they found that men often displayed hyperalgesia symptoms. While the authors were able to replicate findings showing women trauma survivors were less likely to experience hyperalgesia, the question remains unanswered regarding the mechanism and reason for the differences displayed by sex. Wang et al. (2016) speculated if they limited the protein interacting with C kinase 1 (PICK1), they would decrease or reverse the hyperalgesia seen with remifentanil. They hypothesized that PICK1 would act on the NMDA receptors, which

have been felt to play a role in OIH, and whether the rat displayed remifentanil induced hyperalgesia was dependent on the amount of PICK1 present. Testing was done at 2- and 48-hours post remifentanil infusion based on the literature Wang et al. (2016) had researched previously regarding onset and peak of remifentanil induced hyperalgesia. Wang et al. (2016) found that PICK1 did have an impact on remifentanil induced hyperalgesia. In fact, when PICK1 was suppressed it could partly prevent hyperalgesia and reverse the remifentanil-induced glutamate receptor 2 expression, but no effect was seen on glutamate receptor 1 expression (Wang et al., 2016, p. 780). These results suggested that a potential future treatment for remifentanil induced hyperalgesia should include targeting PICK1.

There has been some speculation that hyperalgesia is sex dependent. Arout, Caldwell, Rossi, and Kest (2015) wanted to expand further on previous research that showed NMDA receptor and melanocortin-1 receptor (MC1R) antagonists reversed morphine induced hyperalgesia (MIH), but the reversal was sex dependent. In this study, they wanted to "elucidate the precise location(s) of action of the regulatory mechanisms that underlie MIH" (Arout et al., 2015, p. 367). This study did not identify the mechanism behind MIH, but it did determine that male rats exhibited MIH that was solely influenced by NMDA receptors. They further discovered two exogenous chemicals that when given to both sexes, would only display effects with only one sex. Additionally, female rats who had ovariectomies would exhibit the same results as the males and display weaker MIH symptoms. Wasserman et al. (2015) also noted with their male participants, hyperalgesia induced by fentanyl was increased in males only when going from placebo to fentanyl. It was thought that there may be some sex-mediation of

MIH through NMDA in male mice and melanocortin-1 receptors in female mice which may also be displayed in humans, or a similar mechanism, but at the time of their study it remained unclear. What the studies showed is that opioids taken either long term or with high MME, would be more likely to cause OIH for these individuals than other people.

Education for and About Opioid Prescribing Practices of Providers

Opioid prescribing practices of providers has been under scrutiny for years as the opioid crisis continues to impact the nation. As a result of this opioid addiction, opioid tolerance, opioid overdose related deaths, and OIH have continued to climb. Both the Centers for Disease Control and Prevention (CDC) and the National Institute of Health (NIH) are driving education for providers regarding opioid-prescribing practices and assisting in creating guidelines for providers. The American Pain Society has also joined the effort with establishing guidelines for treatment of operative-related pain in an effort to decrease the need for opioid analgesics needed during the patient's recovery process. As the number of opioid prescriptions decreases, both for chronic and acute non-cancer pain, the incidence of opioid related disorders and deaths will continue to decline.

McCalmont, Jones, Bennett, and Friend (2018) wanted to determine whether Oregon healthcare providers utilized the CDC guidelines, what their perceptions of the guidelines were regarding the less than or equal to 90 MME per day, and the training they received. Additional insight was sought regarding what conditions might sway the provider in one direction or another influencing their confidence and consistency in following the current opioid prescribing recommendations. What they had found was 95% of the 417 respondents started patients on opioids, with 64% of providers prescribing opioids chronically (McCalmont et al., 2018, p. 105). Regarding the

familiarity of providers with the CDC guidelines published in 2016, 91% had either read it or were familiar with it but only 57% admitted to using it (McCalmont, Jones, Bennett, & Friend, 2018, p. 110). Most of the respondents were in favor of the 90 MME per day guideline providing support of this contested limit for pain control. It was also determined that continuing medical education requirements for all providers regarding chronic pain management was supported.

Holliday et al. (2017) wondered if early-career general practitioners would make changes in their opioid prescribing practices after receiving education about opioid prescribing. A multidisciplinary team including pain, addiction, and public health physicians in addition to a psychologist and general practice medical educators provided the education (Holliday et al., 2017). The education they received was through a "90-minute face-to-face educational session conducted during a day-long educational release workshop and access to postworkshop online resources" (Holiday et al., 2017, p. 279). In the study, Holliday et al. (2017) found that there was no significant change in opioid prescribing rates after the education and, in fact, in some areas it increased at three- and six-month evaluations. While it did not have the desired impact on actual prescribing rates, there were more practitioners reporting intent to decrease their opioid prescribing. Holliday et al. (2017) deemed that getting practitioners to decrease their opioid prescribing for chronic non-cancer pain needed to have a more targeted approach for a significant decrease to occur.

Chen et al. (2019) sought to determine the effect a controlled substance utilization management (CSUM) program had regarding prescribing practices and health outcomes. Chen et al. (2019) noted that the CUSM was a low cost and simple initiative to help

decrease the volume of controlled substance prescriptions. They found the use of a CUSM did work in decreasing the volume of controlled substance prescription patterns and prescribers after an intervention occurred, with most of the decrease noted with opioid prescriptions. Even though there was a decrease in the quantity of controlled substances, the overdose rate did not decrease much. Chen et al. (2019) believed there needed to be a more focused approach with more coordinated efforts to reduce the overdose rate.

Onishi et al. (2017) noted that Japan does not prescribe as many opioids as the United States and they wanted to know what the differences were between the two country's physicians. They received a low response rate from both country's physicians, 10.1% of the Japan Primary Care Association (JPCA) and 18.5% of the American Academy of Family Physicians (AAFP) in Oregon with reminders sent four times to JPCA members and three times to AAFP members. What they found was physicians in the United States were more likely to prescribe opioids, 66.0% in the United States compared to 27.3% in Japan (Onishi et al., 2017, p. 250). The reason the United States physicians gave was that it was thought to be the "standard of care for both acute and chronic pain" more frequently (Onishi et al., 2017, p. 251). Onishi et al. (2017) also found patient expectations and satisfaction were influencing opioid prescribing rates in the United States. This indicates that education for patients regarding pain management, both acute and long-term, plus the problems associated with long-term use of opioids needs to be a priority. Additionally, patients and clinicians should receive education regarding alternative measures to control pain, especially chronic pain. These methods

include utilizing medications that are not opioids but help relieve patients' pain without the potential complications and side effects of opioids.

Alternative Analgesics

Alternative analgesics have been used for many years and include methods from alternative medicine such as aromatherapy, acupuncture, massage therapy, and electrotherapy with a transcutaneous electrical nerve stimulation (TENS) unit. Other medications that are effective in treating pain are antidepressants, anticonvulsants, non-steroidal anti-inflammatory drugs (NSAIDs), and topical medications in gel or patch form. Even the use of heat and ice in combination of alternative analgesics or alone have been effective in reducing pain.

Krebs et al. (2018) evaluated the effect of opioid versus non-opioid medications for those who had chronic back or osteoarthritis pain in their hip or knee. They believed opioids would lead to better pain control but would have more side effects. The non-opioid pain regimen consisted of acetaminophen and NSAIDs, adjuvant oral medications (such as antidepressants and gabapentin), topical analgesics, medications requiring prior authorization from the Veteran's Administration (i.e. pregabalin and duloxetine) and tramadol (Krebs et al., 2018, p. 874-875). The patients who were taking opioids had no significant difference in their pain-related function or pain intensity and had more medication related side effects than the non-opioid group. Only anxiety was better in the opioid group, which was cited as being "consistent with the role of the endogenous opioid system in stress and emotional suffering" (Krebs et al., 2018, p. 880). Krebs et al. (2018) concluded that opioids were not the better treatment for moderate to severe chronic back pain or osteoarthritis pain in the knee or hip.

Moss, Benson, Will, and Wright (2017) evaluated the use of etoricoxib, a Cox-2 inhibitor, for 14 days to see if it would improve pain quality and intensity, and hyperalgesia for people with osteoarthritis of the knee compared to placebo. After the course of treatment, the etoricoxib group had considerable improvements with pain, 21.7% felt improvement after treatment with etoricoxib compared to 6.5% with the placebo; for stiffness and function, etoricoxib decreased 30.7% by day 14 compared to 9.8% higher for the placebo group (Moss et al., 2017, p 1784). Hyperalgesia and neuropathic pain were significantly improved. Moss et al. (2017) suggested further research be conducted to investigate the impact NSAIDs would have on centralized-meditaed pain, such as hyperalgesia. Other than opioids, NSAIDs have been a consistent treatment for arthritis and are considered second-line therapy for osteoarthritis (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 594).

Uchio et al. (2018) sought to determine duloxetine's safety and efficiency in treating Japanese patients with osteoarthritis pain. A total of 353 patients received either placebo or 20mg duloxetine capsules over a 14 week period. The participants received one capsule for one week, two capsules for two weeks, and three capsules for 12 weeks. The researchers discovered that 63.3% of 177 patients on duloxetine had a sustained reduction on their average pain, compared to 43.8% of 176 patients who received the placebo; they also found that 71.2% of 177 patients on duloxetine had a sustained 24-hour average pain score compared to 42.4% of 176 patients who received the placebo (Uchio et al., 2018, table 2, p. 813). There were no reported side effects outside what had already been known for duloxetine during the study. A further study by Enomoto et al. (2018) was done to evaluate osteoarthritis pain of the knee with duloxetine regardless of

the use of NSAIDs. Enomoto et al. (2018) discovered that patients who had taken NSAIDs prior to duloxetine, up to three months before the study, did not have a significant difference in their osteoarthritis pain of the knee or their quality of life. Duloxetine was considered an effective treatment for osteoarthritis pain of the knee plus was a safer alternative than NSAIDs for patients with cardiovascular related comorbidities (Enomoto et al., 2018).

Nahin, Boineau, Khalsa, Stussman, and Weber (2016) evaluated several different complementary health approaches available in the United States for pain management. They looked at methods used to treat chronic pain, back pain, fibromyalgia, osteoarthritis (OA), neck pain, and severe headaches or migraines (Nahin et al., 2016). Nahin et al. (2016) found weak supporting evidence that massage therapy, spinal or osteopathic manipulation would be beneficial to those with back pain, and those who had fibromyalgia would weakly benefit from relaxation and tai chi. The strongest evidence showed: "acupunture and yoga for back pain; acupuncture and tai chi for OA of the knee; massage therapy for neck pain with adequate doses and for short-term benefit; and relaxation techniques for severe headaches and migraine" (Nahin et al., 2016). Glucosamine and condroitin were evaluated regarding their effectiveness in treating osteoarthritic pain; however, there were mixed results between multiple studies. Overall, these alternative measures were felt to be safe with few incidents occuring with the few that did occur, were mild in nature ranging from gastrointestinal distress due to the natural supplements and muscle soreness from tai chi and yoga. Pan et al. (2016) compared collateral meridian therapy to local tender area-related meridians therapy for chronic shoulder pain of myofascial origin. Their goal was to discover the most effective

treatment for improved functional recovery and pain relief. The participants were not allowed to take any pain relievers except paracetamol (Tylenol) during the duration of the study. What Pan et al. (2016) found was that collateral meridian therapy proved to be more effective to treat pain and improve functional recovery. Both groups also had electrotherapy stimulator (EES) during each session. Pan et al. (2016) used the EES therapy the same way they would have used a TENS unit, and they felt that because of the electric pulses it sends through patches on the skin, the EES would be like an electroacupuncture session and endogenous opioids would be released assisting with analgesia. The most significant effect of the EES was noted with the collateral meridian therapy group.

Aranha, Müller, and Gavião (2015) compared electroacupuncture and acupuncture on women who had myofascial pain in the upper trapezius, with SHAM acupuncture. Their thought was that electroacupuncture would be more effective in relieving the participants' pain and increasing the range of motion in their neck. While both the electroacupuncture and acupuncture was felt to be more beneficial than the SHAM acupuncture, participants reported better results with the electroacupuncture and had increased pain relief to both sides than any of the tested methods (Aranha et al., 2015). Both the electroacupuncture and acupuncture groups noted a decrease in headache complaints and some neck movement improvement.

Boonruab, Nimpitakpong, and Damjuti (2018) wanted to determine if hot compresses, with or without herbs, or topical diclofenac was the superior treatment for myofascial pain in the upper trapezius. All participants had an occupation that required them to use a computer. Boonraub et al. (2018) reported significant pain relief and

improvement in physical and mental components of their quality of life of participants in all groups. Boonraub et al. (2018) also found the hot herbal compresses were better than the other two groups; however, it was not a statistically significant increase and there is no given definitive reason. Alternative medicine does have its advantages in decreasing pain and should be included when attempting to provide analgesia for patients. Some advantages of alternative medicine are fewer side effects, decreased risk for addiciton and overdose related deaths, and a decreased risk of medicaiton interactions.

Summary

The opioid crisis in the United States continues today as opioid prescriptions continue to rise as a result of pharmaceutical companies reassuring providers their patients would not become addicted since the late 1990s (National Institute of Health, 2019, para. 2). There has not been sufficient monitoring of opioid prescribing rates and education about opioid addiction until recently. As a result, conditions such as opioid addiction, overdose, overdose related deaths, and OIH continue to rise, leaving healthcare providers and nurses struggling to recognize and treat these disorders. The challenge for OIH patients and those providing care for them is that OIH is not fully understood. As a result, the exact mechanisms are not well known and there are no diagnostic criteria for providers to use for diagnosing and treating OIH. It is currently thought that OIH is due to upregulation or alteration of NMDA or μ-opioid receptors (Koo et al., 2017). This has led researchers to begin looking at alternative methods to treat chronic pain in an attempt to decrease the demand for opioids and their complications.

Currently there are several different methods to treat pain, with increasing non-opioid and alternative medicine options for providers and patients to utilize to help

decrease the incidence of OIH. While OIH is not a new concept, healthcare providers and nurses do not know much about OIH or medications to help decrease its frequency. The CDC and NIH are driving education and guidelines for opioid prescribing practices, but still there is a knowledge gap for OIH. Healthcare providers, nurses, and the public all need to be aware of all complications of opioids including OIH. Education for everyone needs to occur if there is ever to be a decrease in opioid use and OIH.

CHAPTER III

Methods/Plan

Project Design

This project examined the knowledge of healthcare providers, nurses, and the public about opioid induced hyperalgesia. It also assessed the effectiveness of targeted educational sessions for each group. Healthcare providers and nurses were given the opportunity to participate in a reassessment survey to not only assess any changes to their practices they have made, but also to evaluate how effective the public education was.

Sample/Target Populations

There were two target groups in this project. One group was healthcare providers; this group includes those who have a license to prescribe, dispense, or administer opioids. The other group included those who do not have a license to prescribe, dispense, or administer opioids. Even though there were some people who can administer opioids via a certification, they do not have a license that requires extra education and clinical skills to administer. The target area for the project was the four-state area, with an emphasis on the population in southeast Kansas. Public participants were recruited via social media and advertisements through Labette Health for their education session. Healthcare providers were recruited also via social media in addition to receiving an invitation for education about OIH. Compensation for healthcare providers was continuing education

credits awarded after finishing the project's requirements. Healthcare providers and nurses will be offered placement in a drawing for an Amazon gift card if they chose to participate in a follow up survey. The public would be placed in a drawing for an Amazon gift card if they provided an email address and completed both the pre- and post-education surveys. The target age group was anyone age 18 years or older.

Inclusion/Exclusion Criteria

Healthcare providers who had an active license to prescribe, administer, or dispense opioids that is free from any restrictions in their respected fields were included. Exclusion criteria was anyone under the age of 18 years, currently incarcerated, mentally handicapped, or declared mentally incompetent. Students of healthcare professional training programs would be excluded from the healthcare provider category due to them not having an active license. Participants who were not English proficient were excluded from both groups.

Protection of Human Subjects

This project would have minimal to no risk for participants. There was no protected health information accessed and all anonymized data remained in an electronic form to be deleted 18 months after the close of the survey. Since there was no protected health information accessed and participants were at minimal to no risk of harm, exempt status was sought from the Pittsburg State University Institutional Review Board. All participants were at least 18 years of age and participation was voluntary. There was a chance that some of the participants will be pregnant and a chance that some of the participants who were less than 18 years of age would lie about their age on surveys. Other than these two groups, there were no vulnerable populations involved. There was

no coercion or deception about the purpose of the study and responses to the surveys would remain anonymous. No risks were associated with the surveys and participation was voluntary. Healthcare providers and nurses were offered continuing education credit for completion of their education session, and both target groups were offered to be placed in a drawing for an Amazon gift card for follow up survey participation. SurveyMonkey.com was utilized for the survey and participants were given the option to provide email addresses for follow up surveys.

Ethical Considerations

There were minimal ethical concerns with this project. The participants were expected to participate in the education sessions which were not anonymous. The healthcare providers and public did not have anonymity because their education sessions were held via Zoom or in person depending on the group. Follow up surveys would require the participants to provide an email for future contact, not guaranteeing anonymity. Their survey responses were kept confidential.

Survey answers on SurveyMonkey.com were anonymous due to the volume of responses received. With the guarantee of anonymity, the answers to questions should be honest. Even though answers from the survey were anonymous, there could still be some participants who did not answer the questions honestly. Survey questions were written simply, with no intent to confuse participants, and without intent to increase their statistical power.

Instrument

There was a total of two surveys, one for each target group. The questions for each survey were a mixture of dichotomous, multiple-choice, and rating questions. There

were five questions to determine eligibility for the survey and to determine which survey was pertinent for the participant. The demographic questions included age, gender, type of license, profession, and license restrictions, if any. If they provided answers that were inconsistent with the study's design, they were disqualified, and their answers were excluded.

After demographic and qualifying questions were answered by the participants, the survey participants were divided into different survey groups and continued to take the survey. In the survey for healthcare providers, questions included ranking analgesics in the order of treatment; the frequency with which they have been dispensed, prescribed, or administered opioids in the previous six months; the conditions for which they most frequently considered utilizing opioids for pain; and their perceptions about opioid addiction. The next section asked what the definition of OIH was, whether the respondent believed it was a true diagnosis, if they feel it was a tolerance issue or separate diagnosis, if they felt patients could be diagnosed with OIH are drug seeking, and how often they estimated they saw patients who fit the diagnosis of OIH in their practice. The final two sections would be assessing their education regarding alternative analgesics and their perceived effectiveness; how frequently they recommended, prescribed, or administered alternative analgesics; the frequency of realistic pain expectation conversations with patients; what education they received during training on opioid prescription; and any education they received during their training regarding how to wean patients off opioids.

For non-healthcare providers, the first set of questions would include questions about whether opioids were first line treatment for the participant's pain; the frequency

the participant took opioids per week; if the participant has asked a provider for opioids within the last six months and, if yes, the frequency with which the participant had asked for opioids within the last six months; and what problems the participant felt to be worthy of guaranteed opioid prescriptions. The next section assessed their knowledge regarding the risks associated with opioids, their knowledge of the definition of OIH, and their beliefs regarding the veracity of an OIH diagnosis. The last two sections ask if the participant uses alternative analgesics, how often, and how likely they were to use them first; how well alternative they feel alternative analgesics help their pain; what kind of alternative analgesics they used the most; whether they had a realistic pain expectation conversation with their provider; what their realistic pain expectations were; and if they knew how and where to get help for opioid-related problems.

Operational Definitions

Terms utilized and previously defined are as follows:

1. Opioid induced hyperalgesia (OIH) – "the increased sensitivity to painful stimuli as a result of opioid use" (Hayhurst & Durieux, 2015, p. 485)
2. Opioid – medications that "bind to opioid receptors in the central nervous system with analgesic effect primarily associated with μ-receptor binding" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 102)
3. Morphine milligram equivalent (MME) – tool used in prescribing opioids that converts the opioids into a similar unit that prescriptions are based on (Pino & Covington, 2018)
4. Healthcare provider – any person who has a license to prescribe, dispense, or administer opioid medications

5. Patient – someone who is receiving care and/or treatment for a condition from a physician, physician assistant, or APRN
6. Alternative analgesia – pain relief that does not involve opioids
7. Nonsteroidal anti-inflammatory drug (NSAID) – medication class which "have anti-inflammatory, analgesic, and antipyretic activity" (Arcangelo, Peterson, Wilbur, & Reinhold, 2017, p. 102)
8. Chronic opioid use – opioid taken for longer than 90 days (Thornton et al., 2018)
9. Acute opioid use – opioids taken for less than 90 days (Thornton et al., 2018)

Procedure

IRB approval

This project utilized human subjects and per protocol at Pittsburg State University, the protection of human participants was addressed by the Institutional Review Board (IRB). This project involved minimal risk to human participants. There was no PHI accessed and no professional or personal risk in conjunction with the questionnaire. There was potential for some women who are pregnant to be part of the study; however, they were only subjected to questionnaires and lectures. There were no other vulnerable or special participants in the project. An application was submitted to the Pittsburg State IRB for expedited review.

Timeline

Once IRB approval was given, the initial surveys were created and posted on social media and given to participants of the continuing education class upon registration.

Healthcare providers were given their educational session in late spring, and the public received their education late May or in June. Reassessment of volunteers for both groups would occur 30-60 days after completion of the education sessions.

Resources needed

Participants of the project and the authors were identified as human resources for this project. Data was tabulated by the lead author with assistance from faculty co-authors. Financial support for expenses was provided by Labette Health for public education, KU-AHEC for provider education, and by the lead author for any additional expenses.

Continued fees were incurred by the lead author regarding maintaining the survey through a hosted web site, and during the creation of educational material for both target groups. Shared cost between the lead author and Labette Health for material given to the public at their session was incurred. There were no anticipated legal fees for this project.

Study experience

Direct participation was required for this project by both groups. The initial survey to evaluate the knowledge or participants was posted on social media. The participants were taken to an informed consent page stating the purpose of the study, participation requirements for each group, and any risks that could be incurred. Once the participant agreed to the conditions, they were taken to the initial portion of the survey to determine which participating group they belong to; after completion of those questions, they were taken to the appropriate survey for further questions. Before the healthcare provider education began, the participants were given 10 to 15 minutes to answer the survey assessing their prior knowledge, and afterwards they were given another survey to

assess the impact of the education delivered. The public was to receive their pre-education survey at the beginning via link in the virtual classroom or paper. It was decided that a post-education survey for the public would be through the follow up provider survey. Both surveys had an estimated participation time of no more than 10 to 15 minutes. If healthcare providers and nurses wished to be contacted for a later evaluation survey of the provided education, including implementation into their practices, they were asked for their email address a link could be sent to. The series of questions would take no more than 15 minutes to complete.

Data collection and outcome

Data was tabulated automatically via SurveyMonkey.com and further breakdown was performed by the lead author and faculty co-authors. The data was consistently collected as a result of being electronic. The data collected from the healthcare provider surveys was:

1. Knowledge about OIH;
2. Attitude about the diagnosis of OIH, patients who have OIH, and OIH versus drug seeking;
3. Knowledge regarding opioid prescribing, alternative analgesia, weaning of opioids, and how to discuss realistic pain treatment with patients;
4. The frequency of OIH patients in the providers practice, opioid prescription/administration rate, and alternative analgesic recommendation;
5. Most frequently prescribed opioids and the rate at which they were prescribed;

6. Impact of OIH education on opioid prescribing/administration rate, recommendation of alternative analgesics, ability to have realistic pain treatment conversations with patients, and belief of OIH existence.

The data collected from the public surveys was:

1. Knowledge about OIH;
2. What conditions participants consider an opioid for pain control warranted and whether the participants' prescribed opioids were considered first line treatment;
3. Frequency of taking opioids per week on average and frequency of opioid seeking behavior in 6 months, if applicable;
4. Knowledge of all risks associated with opioids, use of alternative analgesics, and how to get help for opioid addiction;
5. Whether there was a difference between OIH and opioid tolerance;
6. Whether they had or were comfortable having a realistic pain treatment and expectation conversation with their provider;
7. How frequently they used alternative analgesics, belief on their efficacy, and the ones used most frequently;
8. The impact OIH education on pain relief methods, alternative analgesics, and likelihood of utilizing alternative analgesics; and
9. The impact OIH education had on their comfort level of talking with their provider about realistic pain treatment and pain expectations.

Treatment of Data/Outcomes/Evaluation Plan

Tools/instruments described and linked to measures and objectives

The questions for this project were assessed and guided by the information received by the surveys. The outcome goals and evaluation plan outlined in the logic model (Figure 1) and the research questions described previously provided the guidance for measuring outcomes. Electronic surveys created and maintained by SurveyMonkey.com were the source utilized. Responses to surveys were scored on a 5-point Likert scale, yes/no, ranking, and selecting the most appropriate response.

The questions for providers utilizing a 5-point Likert scale were related to their perceptions of:

1. OIH diagnosis;
2. Addiction;
3. Need for education about alternative analgesia, opioid prescribing, and weaning patients from opioids;
4. Comfort level about patient conversations for realistic pain expectations and treatment;
5. Likelihood of prescribing or administering opioids first; and
6. Belief that OIH is another form of drug seeking.

Ranking questions were the most likely prescribed or administered opioids, and the most frequently prescribed or administered opioids by the provider.

Questions for select the right answer were:

1. Frequency of dispensed/administered/prescribed opioids,
2. OIH definition, and
3. Estimation of OIH patients seen in practice.

There was only one yes/no question which was regarding whether tolerance is part of the OIH definition or a separate entity.

Questions for the public that utilize 5-point Likert scale were:

1. Their belief opioids are the best treatment for pain;
2. Whether they believed OIH is a real diagnosis;
3. Likelihood that alternative analgesics worked better than opioids; and
4. Their comfort level on having the conversations of realistic pain relief treatment and pain expectations with their providers.

The yes/no questions were whether they knew all risks associated with opioids and whether they believed OIH is related to tolerance. Ranking questions were for what conditions warranted opioids and what opioids they have received the most. Select the right answer questions were the participants:

1. Estimated frequency of taking opioids per week,
2. Frequency of seeking opioids in the previous 6 months,
3. Definition of OIH,
4. Use of alternative analgesics, and
5. How they would most likely obtain information for help with opioid addiction.

Survey questions for both target groups for post education evaluation were 5-point Likert questions asking them about the impact the education had:

1. On their opioid prescribing/administering or consumption/requesting rates,
2. Likelihood of using/recommending alternative analgesics,
3. Increased frequency of conversations related to realistic pain treatment and expectations, and

4. Belief that alternative analgesics are more beneficial than opioids in pain relief.

Follow up questions for those wishing to participate were 5-point Likert questions assessing the impact of OIH education had on their practice or personal lives. These questions would include:

1. Frequency of use of alternative analgesics since education,
2. Decrease in opioid seeking behaviors, and
3. Development of realistic pain expectations and treatment.

Plan for Sustainability

Survey responses from both target groups defined the initial education effort for this project based on pre-education surveys. After the initial education effort was completed, further survey responses guided the education effort to new target areas for further impact on decreasing opioid usage and frequency of OIH behavior seen. Partnership with Labette Health and other area facilities was sought to continue to provide public and provider education for a larger impact. The lead author continued to research OIH diagnosis criteria, alternative analgesics, APS and CDC recommendations regarding opioid usage, and any practice guidelines for analgesics and weaning of opioids.

There was continuing financial support given from Labette Health to provide education to healthcare providers and public. The frequency of education sessions and their locations determined travel and equipment costs. It was assumed that the facility assisting in providing the education for OIH would take on the financial obligation for advertising the educational sessions. Additional surveys were used to assess the ongoing needs for education regarding OIH knowledge for both target groups.

CHAPTER IV

Evaluation of Results

Restatement of Purpose

The purpose of this project was to educate healthcare providers and the public about OIH. The focus of education was about the causes OIH, any predisposing factors, how to treat patients with OIH, preventative methods, and alternative analgesia for all levels and groups. It was hypothesized that better education would facilitate more preventative programs and care for the public, resulting in fewer cases of OIH. An additional purpose of the project was to evaluate the impact of the education on both healthcare providers and the public after they had received education on OIH. There were 12 questions to be answered after completion of the project.

Description of Population

The study was available to all people age 18 years and older in both the public and the healthcare setting. The healthcare providers who participated in the survey were required to have an unrestricted license that would not prohibit them from dispensing, administering or prescribing opioids. The only requirement for participants from the general public was to be 18 years of age or older. There was a survey hosted on SurveyMonkey.com and published on Facebook prior to the scheduled education sessions that was used to determine the existing knowledge of all participants. The survey was

available from February 14, 2020, until March 13, 2020. There were 149 respondents who had at least started the survey with 79.2% completing it (*N = 118*). Most of those who responded were female and age 40-49 years (*N = 37*) and most had completed college degrees (see Figures 2 and 3).

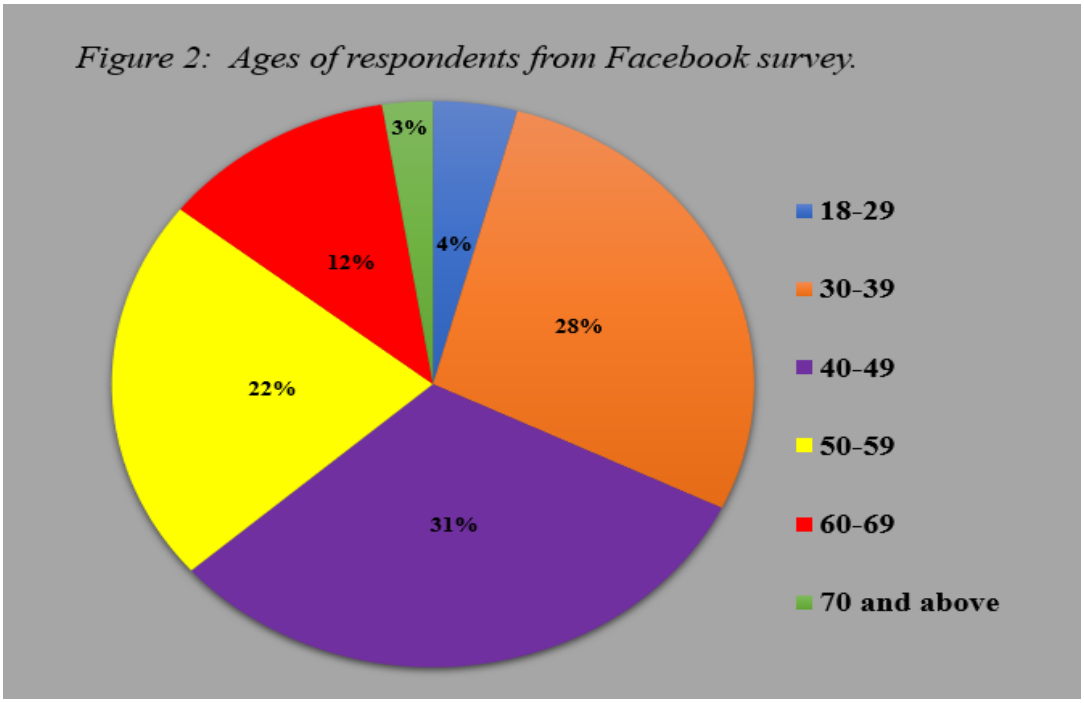
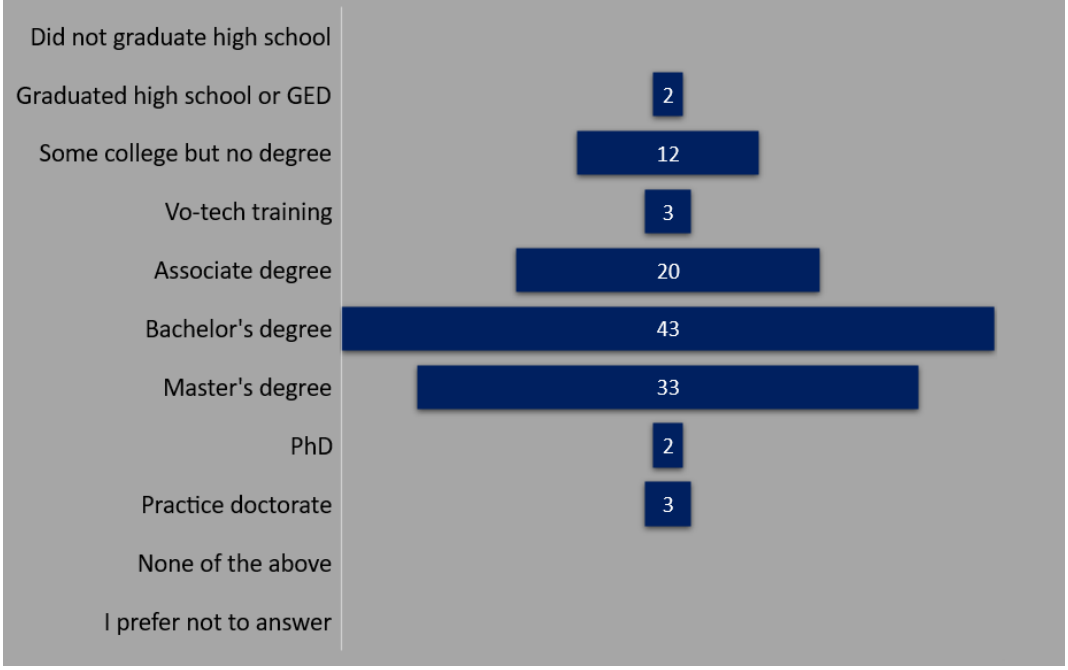
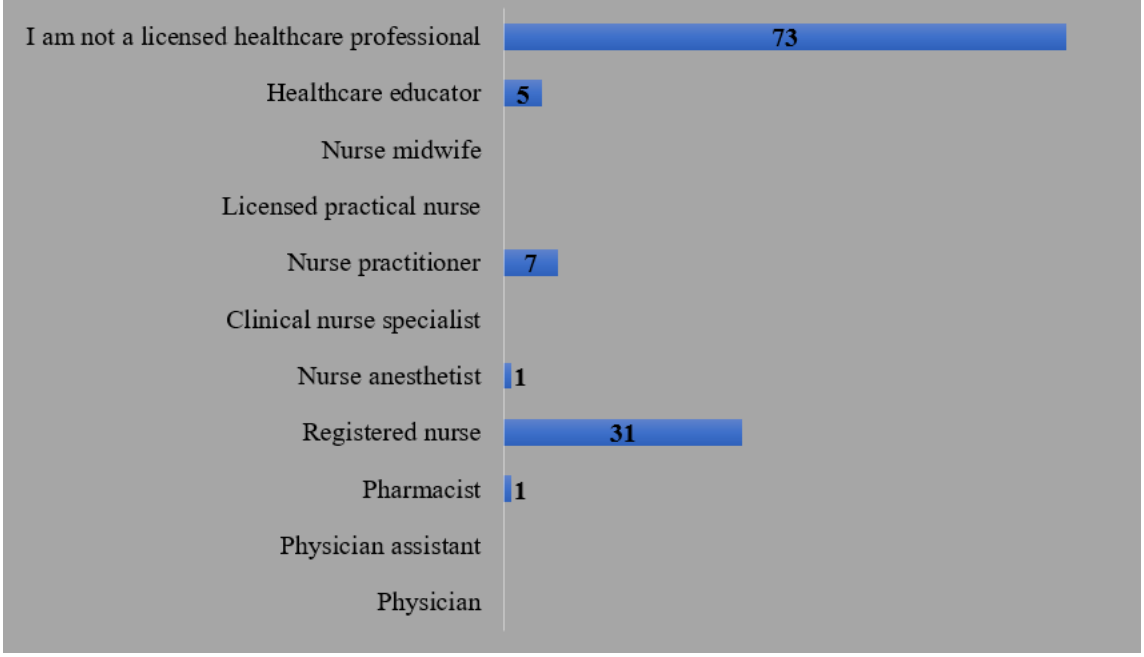


Figure 3: Highest level of education of all respondents.



The healthcare providers and nurses were separated into separate groups through questions on the screening survey on Facebook with the final group of providers and nurses screened by a question about any license restrictions specifically related to opioids applied to them. If they answered no to this question, they were then sent to the public version of the survey instead of their data being used for healthcare providers and nurses. There were 45 participants who had answered their career was in healthcare (see Figure 4), however, only 29 answered their license was active and free of any restrictions involving opioids.

Figure 4: Profession of respondents from Facebook survey.



On November 10, 2020, the first healthcare provider education session, sponsored by Labette Health and KU-AHEC, was held via Zoom. A pre-education survey was sent with the invite on November 3, 2020, and post education survey was sent after the education session. KU-AHEC required a separate survey for participants to complete for their continuing education credits. There were 16 total participants who were included in the final roster. The healthcare careers that were in attendance were nurses, APRNs, patient and nurse educators, physicians, respiratory therapists, and physical therapists. Prior to starting the educational session, only 8 survey responses had been received, but an additional 5 were collected after the start of the session. The focus of the first session was to define OIH, describe the pathophysiology, understand the causes of OIH, identify key risk factors for OIH, and discuss the opioid prescribing practices of providers. After the educational session, only 6 attendees participated in the post education survey, and all participants received 1 credit hour of continuing education credit for attendance.

On December 8, 2020, the second session, sponsored by Labette Health and KU-AHEC, was held again via Zoom. The focus of the second session was how to treat and prevent OIH, the use of alternative analgesics, how to approach patients regarding opioids and pain relief expectations, and how to find help for weaning patients off opioids. There were 8 participants, and healthcare providers in attendance were a radiologist, nurses, a respiratory therapist, a physical therapist, an APRN, and a pharmacist. Only one participant did the pre-session survey, and only one participant did the post-session survey. All those in attendance received 1 credit hour of continuing education. Because only one person did the pre and another the post session surveys, the data collected was disregarded as it would be very limited regarding information and any conclusions.

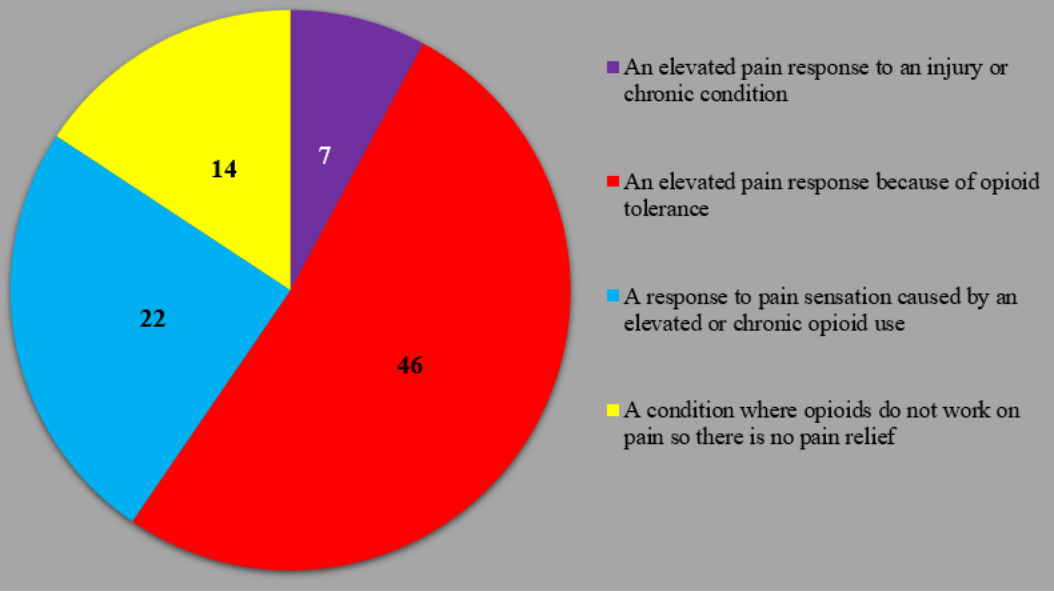
Labette Health sponsored the educational sessions for the public and provided additional gifts to be raffled off for attendance on either December 29 or 30, 2020. The sessions were to be held via Zoom or in person following social distancing guidelines due to the ongoing pandemic. The sessions were advertised via Facebook on the Labette Health page, through shares on Facebook, and in the local paper *The Parsons Sun*. Reservations were to be made via an email to the presenter, and only two people responded. Neither participant was in the target area – one was located in Wichita and was an APRN and the other worked in a hospital located in Pratt, KS. While they both reserved a spot in the educational session, neither person showed. As a result, the public information was drawn from the Facebook survey done from February 14, 2020, through March 13, 2020.

Application of Data to Research Questions

1. Could patients define OIH before receiving education about OIH?

There were 89 respondents from the Facebook survey and only 25% (*N = 22*) were able to correctly identify the correct definition of OIH, with the majority believing it was secondary to tolerance (see Figure 5). This proved that there was some type of education on OIH was needed.

Figure 5: The public's answers for the definition of OIH on Facebook survey.

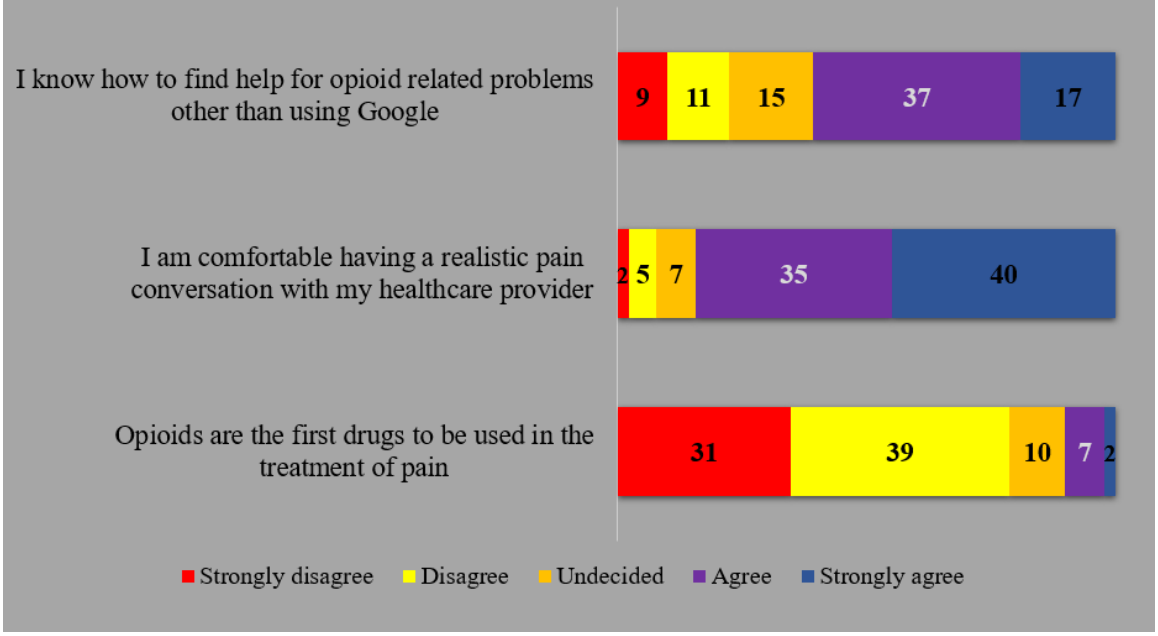


2. What were patients' attitudes and beliefs about opioids and OIH prior to receiving education on OIH?

When asked if they believed opioids are the first drugs to be used in the treatment of pain, the majority either disagreed or strongly disagreed. While there were a few that agreed or strongly agreed that opioids were to be used as first line treatment for pain, there were some that were undecided (see Figure 6). When it came to whether respondents were comfortable having a realistic pain conversation with their healthcare provider, most either agreed or strongly agreed and few disagreed or strongly disagreed

(see Figure 6). Respondents were a little more divided on whether they knew how to find help for opioid related problems using sources other than Google. Most respondents agreed they knew how to find help (see Figure 6). As most respondents on the Facebook survey were college educated, it might have influenced the data received.

Figure 6: The public beliefs regarding opioids on Facebook survey.

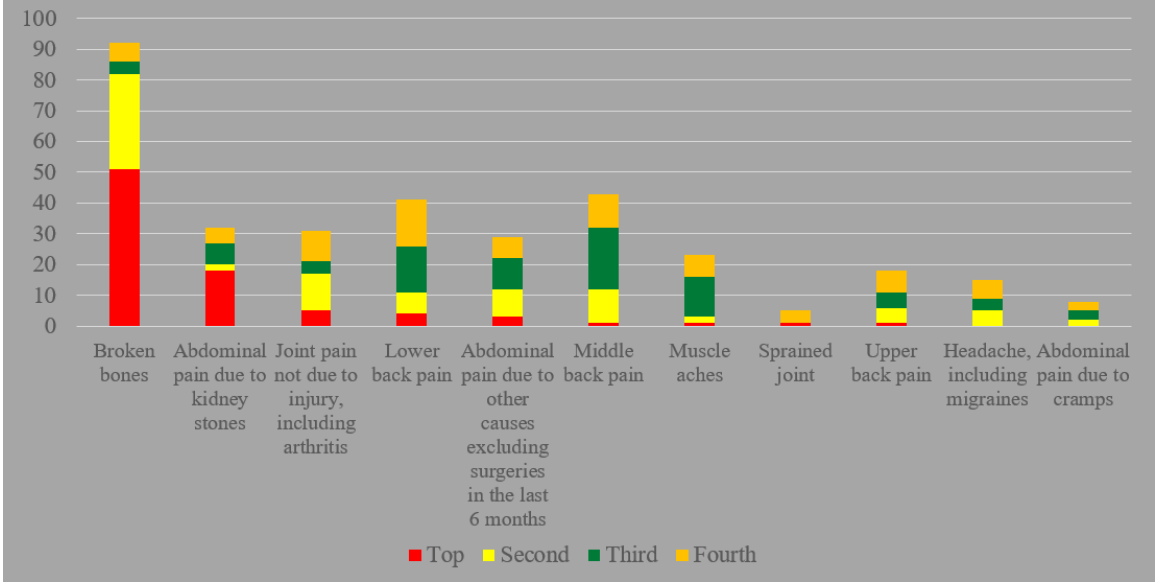


When it came to indicating what conditions opioids should be used for, the public's top reason was fractures, second was abdominal pain due to kidney stones, third was lower back pain, and fourth was headache including migraines (see Figure 7). Fractures can cause a significant amount of pain and not surprisingly, they were ranked at the top. Fractures were added as an option in order to determine if people were reading the survey or if they were just randomly answering the questions because it was anticipated that fractures would be the top answer if the options were fully read by participants.

Headache, including migraines, were selected with the same frequency for the third and fourth top reasons opioids should be used, and they were most frequently

selected for the fourth reason. These results suggest that there is some education needed by patients about the pathophysiology behind migraines, including alternative measures to prevent them like diet, other medications, and supplements. Lower back pain appeared in every level and suggested that there not only needed to be education provided to the public on how back pain can be treated with alternative methods but also to remind providers and nurses that they need to educate patients on why taking opioids are not good practice for the treatment of back pain. Kidney stones are painful, so it was not surprising that they were felt to be a good reason for opioids (see Figure 7). Again, education provided to patients from their healthcare providers and nurses is needed about appropriate opioid use and pathophysiology of the condition.

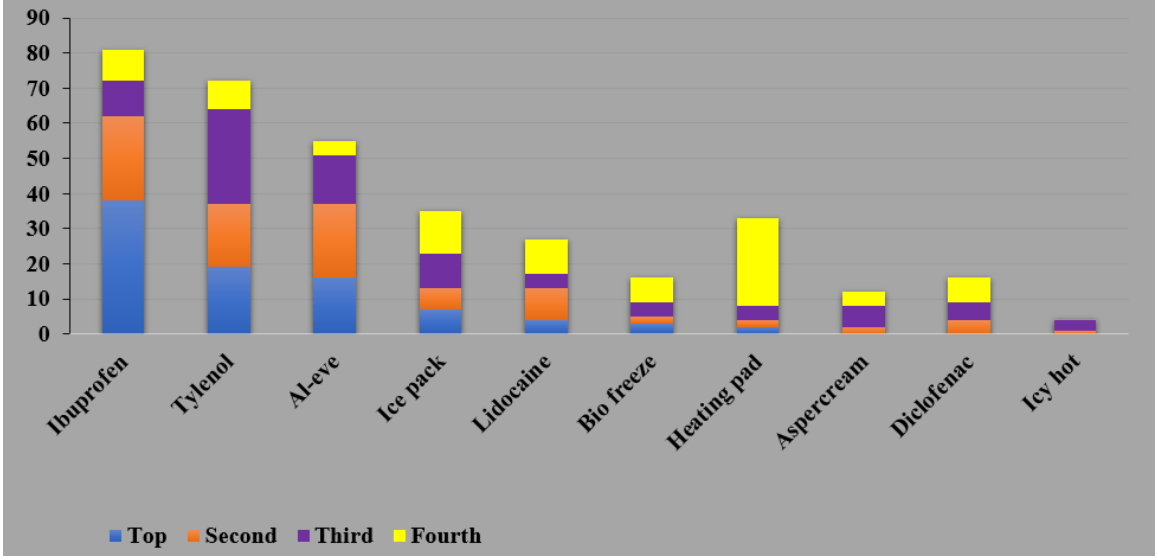
Figure 7: The public's top four reasons opioids should be used from Facebook survey.



Another interesting finding was the most frequently used non-prescription analgesic was ibuprofen followed by Aleve, and Tylenol (see Figure 8). As most of the Facebook survey respondents were in their 30s through 50s, this suggested that many had

milder versions of chronic conditions, such as arthritis or other inflammatory conditions, that later necessitates the use of opioids.

Figure 8: Public's top four non-prescription medications for pain relief.



3. What was the reported use of opioids by patients before receiving education on OIH?

Because no one attended the public sessions, the Facebook survey again was used, but the target area was not well represented. For those that answered, there were 8% (*N = 7*) who said they took 1-10 opioids per week and 92% (*N = 82*) who do not take opioids. When asked how many pills per opioid dose they took, 16% (*N = 14*) reported 1-2 pills, 1% (*N = 1*) reported 3 pills, and 83% (*N = 74*) said they do not take opioids.

4. What were patients' attitudes and beliefs about opioids and OIH after receiving education on OIH?

There were two people who reserved a seat for the public education sessions, however, neither showed up, so education did not take place and no survey was given, leaving this unknown at this time.

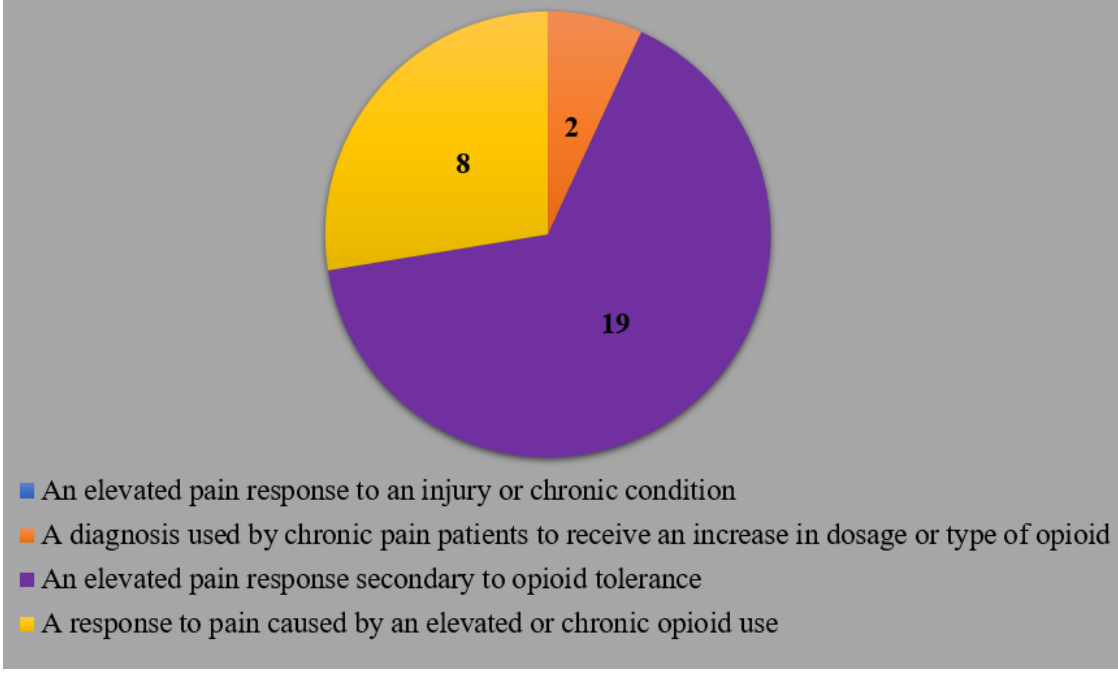
5. What was the reported intended use of opioids by patients after receiving education on OIH?

As there was no education given to the public, this question is unable to be answered.

6. Could healthcare providers and nurses define OIH before receiving education on OIH?

The Facebook survey provided the basic idea of needed knowledge for healthcare providers and nurses during the session. Per the Facebook survey, 65% (*N = 19*) believed that OIH was defined as an elevated pain response secondary to opioid tolerance (see Figure 9).

Figure 9: Healthcare provider and nurse's definition of OIH on Facebook survey



When the pre-session survey was given before the first Grand Rounds, there were only two choices that were selected. Out of the thirteen survey participants, 77% (*N = 10*) defined OIH as an elevated pain response secondary to opioid tolerance with the other 23% (*N = 3*) selected the correct answer. The pre-session survey confirmed the

results from the Facebook survey that healthcare providers and nurses were not able to define OIH prior to receiving any education about OIH. While this question was asked again during the second session as a poll question and on the pre-session survey, only one participant for each answered the question. The poll question participant selected the right answer, but the survey participant defined OIH as an elevated pain response secondary to opioid tolerance.

7. What was the current practice among healthcare providers and nurses regarding OIH and opioids before receiving education on OIH?

The healthcare workers who participated in the Facebook survey listed the top five opioids they utilized in their practice were oxycodone as the top, tramadol second, Norco and Percocet tied for third, oxycodone fourth and fifth (see Figure 10). Even though there are multiple other opioids ranked fourth or fifth most utilized in healthcare providers practices, oxycodone continued to be the fourth or fifth most utilized in the participant's practice. In the pre-session survey, the top opioid was Norco, second was tramadol, third was a tie between tramadol and Tylenol #3 and Dilaudid, fourth was a four-way tie between tramadol and oxycodone with/without Tylenol and Fiorcet and morphine IV, and the fifth was morphine-controlled release (see Figure 11). The percentage of opioids participants utilized in their practice according to the Facebook and pre-session surveys varied slightly with the Facebook participants showing a slightly higher percentage of opioid utilization in their practice compared to the target group in the first Grand Rounds (see Figures 12 and 13). As a result of this, it is suggested the target group is more aware of the dangers of opioids than the group of Facebook respondents.

Figure 10: Top five opioids utilized in the healthcare provider or nurses' practice from Facebook survey.

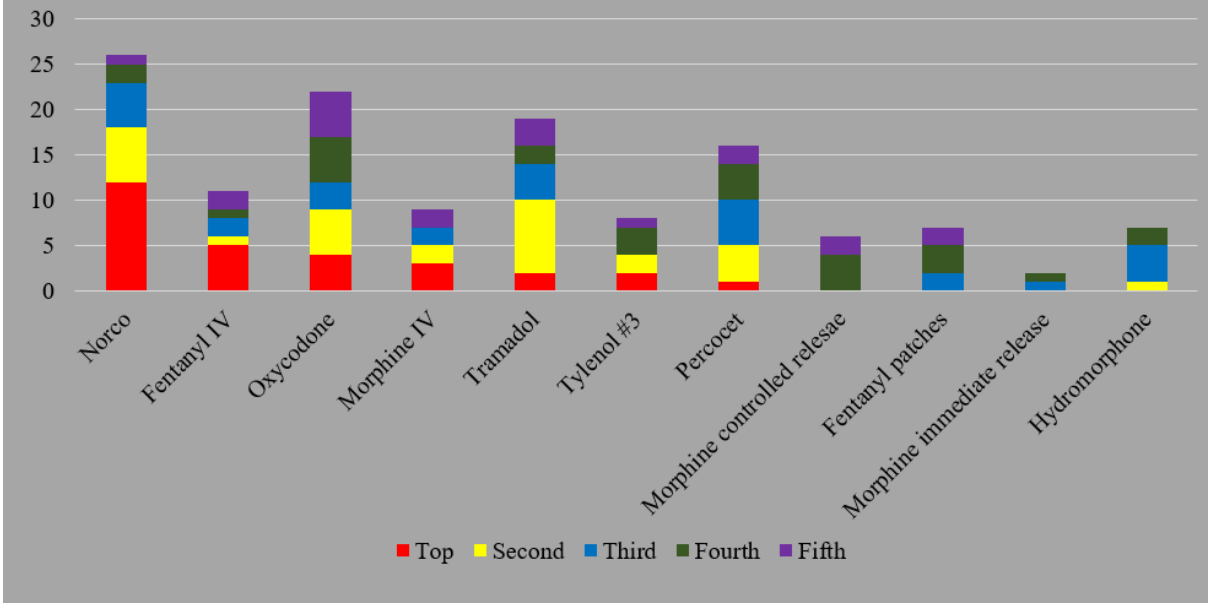


Figure 11: The top five opioids participants utilized in their practice from the first Grand Rounds pre-survey.

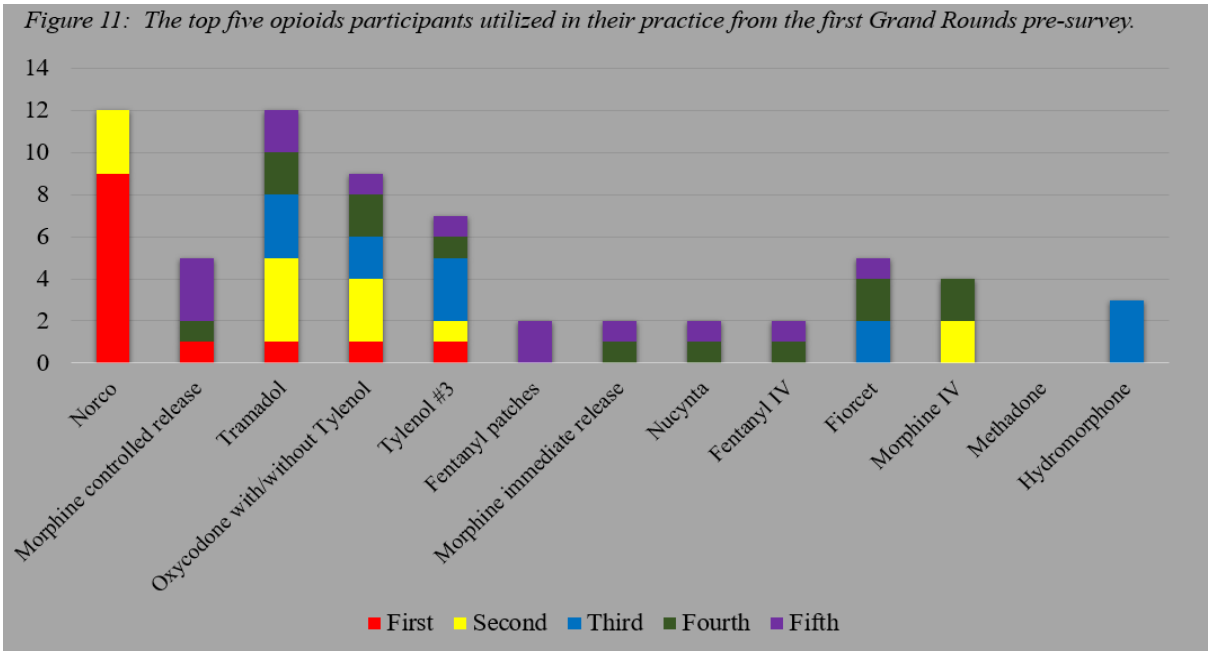


Figure 12: Percentage of opioids healthcare providers and nurses utilized in practice on Facebook survey.

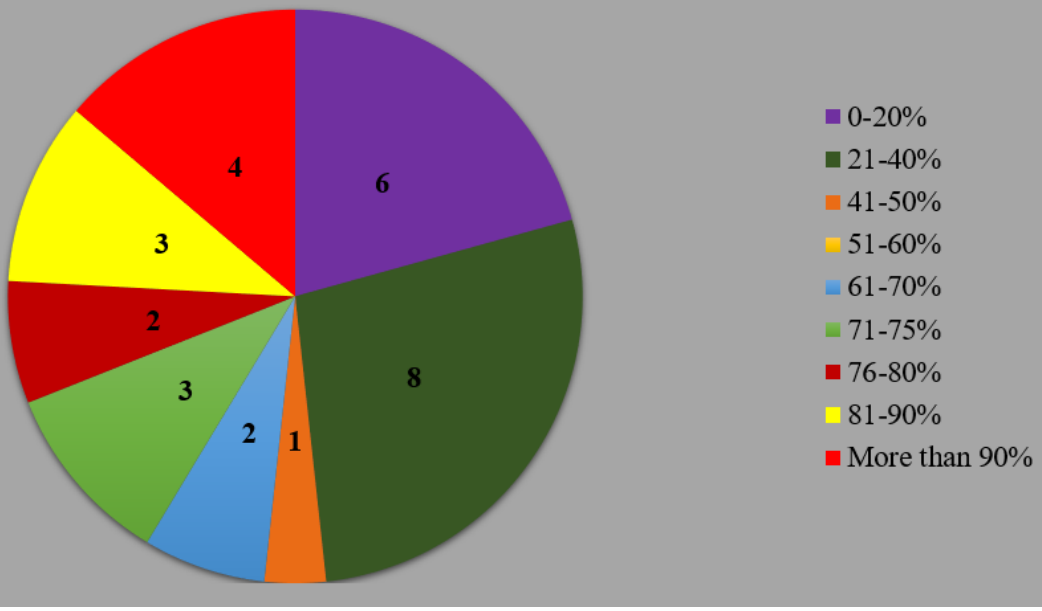
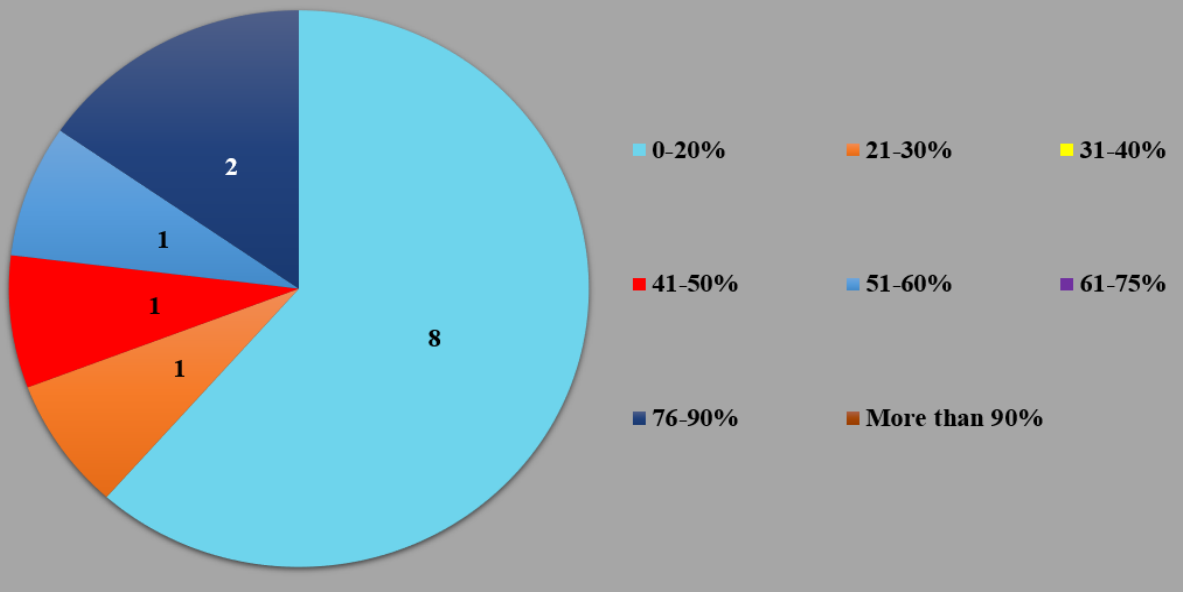


Figure 13: The percentage frequency participants in the first Grand Rounds utilized opioids in their practice in the last six months.



8. What were the beliefs and attitudes among healthcare providers and nurses regarding OIH and opioids before receiving education on OIH?

While participants in both the Facebook and pre-session surveys displayed a lack of knowledge regarding OIH, the answers to their agreement with specific statements

regarding OIH causes and diagnosis told a different story. On the Facebook survey, 79.3% (*N = 23*) believed that OIH was a real diagnosis and pre-session it was 46.2% (*N = 6*) that believed strongly OIH was a real diagnosis, (see figures 14 and 15). This suggests a deficit in knowledge about what OIH is, further supporting need for education.

Figure 14: Healthcare providers' and nurses' agreement with the following statements regarding OIH causes and diagnosis from Facebook survey

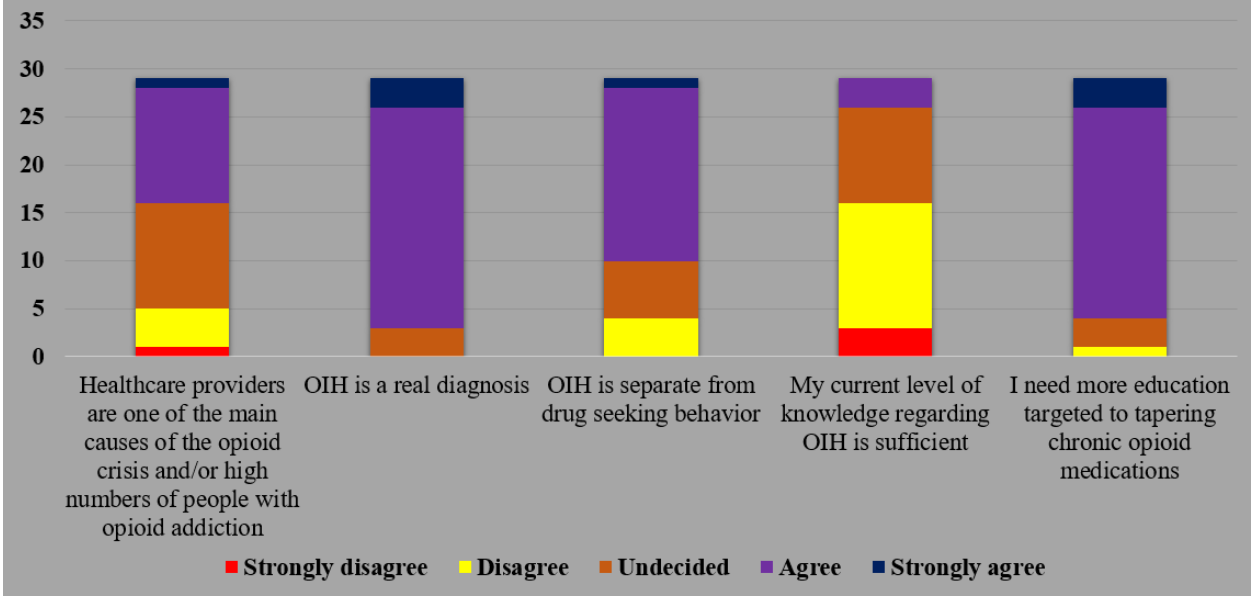
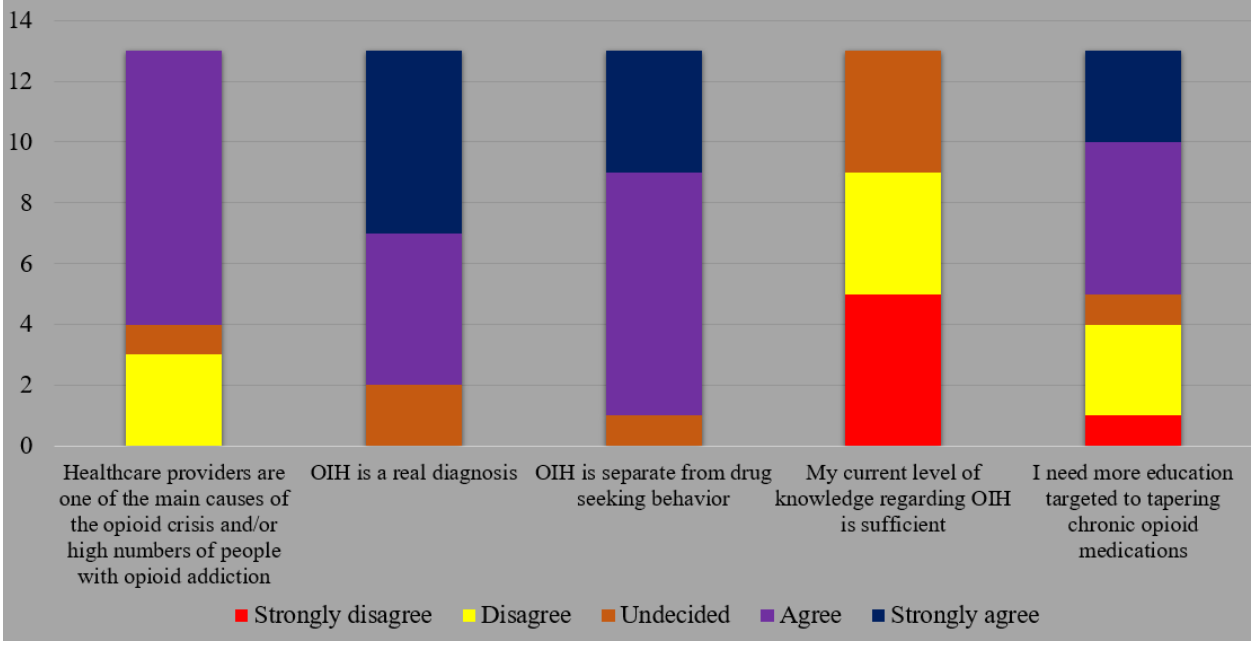


Figure 15: The level of agreement the first Grand Rounds participants had with the following statements regarding opioids, OIH, and tapering.



There was an interesting correlation between the Facebook and pre-session surveys regarding alternative analgesia. It appeared that both groups utilized alternative analgesics in their practices already and believed that they worked for relieving pain including chronic pain (see Figures 16 and 17).

Figure 16: Providers' and nurses' agreement regarding the following alternative analgesics from Facebook survey.

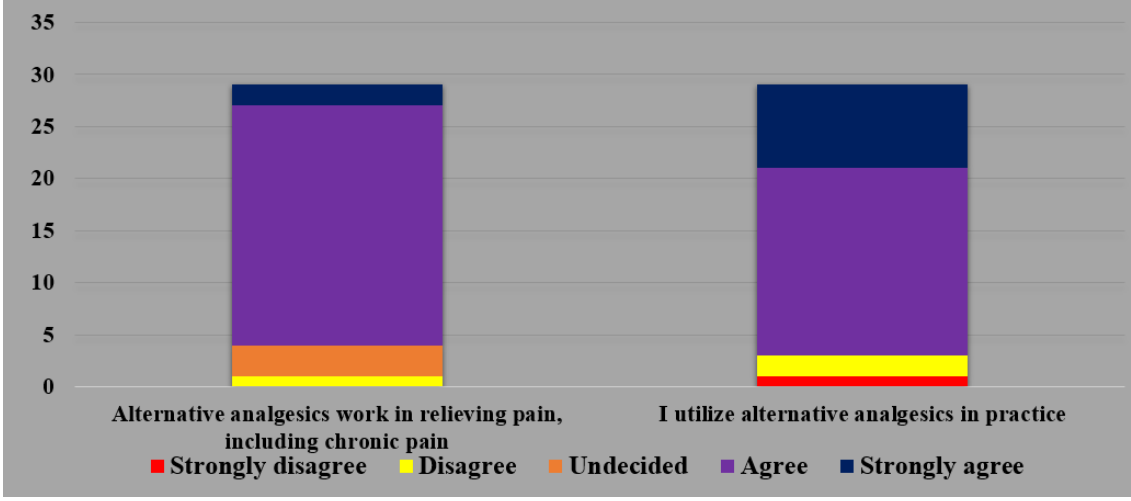
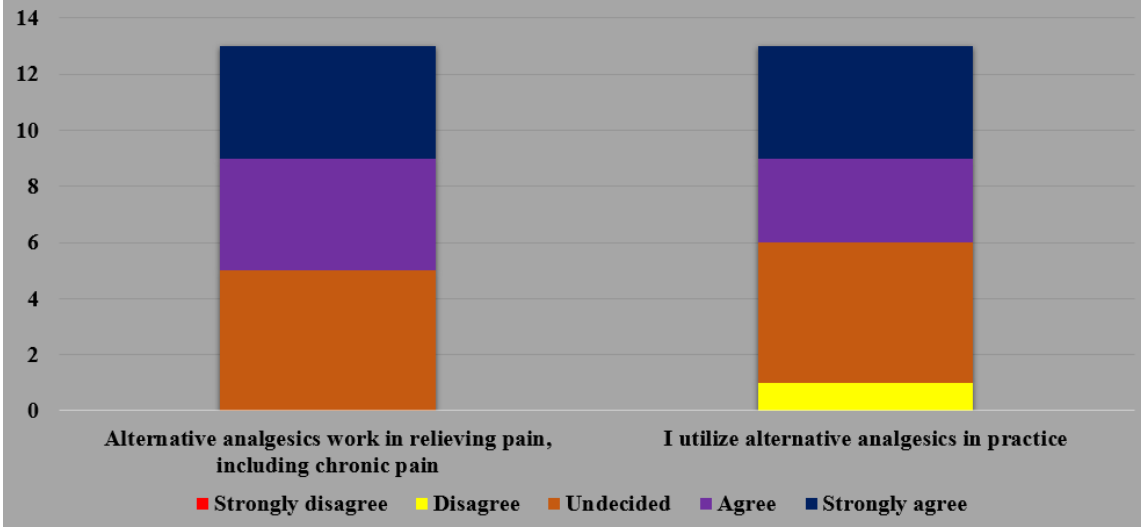


Figure 17: The level of agreement participants from the first Grand Rounds pre-survey had regarding alternative analgesics.



9. Were healthcare providers and nurses comfortable communicating with patients about pain management before receiving education on OIH?

According to the Facebook survey, healthcare providers and nurses were comfortable with having realistic pain conversations with their patients (see figures 18 and 19). On the Facebook survey, 65.5%% (*N = 19*) of participants answered they were willing to have conversations with patients about realistic pain expectations. While many respondents in the pre-session survey agreed they were comfortable with having a conversation with their patients about realistic pain expectations, the total number who strongly agreed was only 38.5% (*N = 5*). In the Facebook survey, 24.1% (*N = 7*) of participants strongly agreed they were comfortable having the realistic pain expectation conversation with patients, and it remained consistent with the target group prior to education, 23.1% (*N = 3*). Based on these results, it appears that healthcare providers and nurses are willing to have the conversation with patients, but it is unclear whether that is happening in real life.

Figure 18: Providers' and nurses' agreement with the following statements about patient conversations regarding opioids, realistic pain expectations, and weaning on Facebook survey.

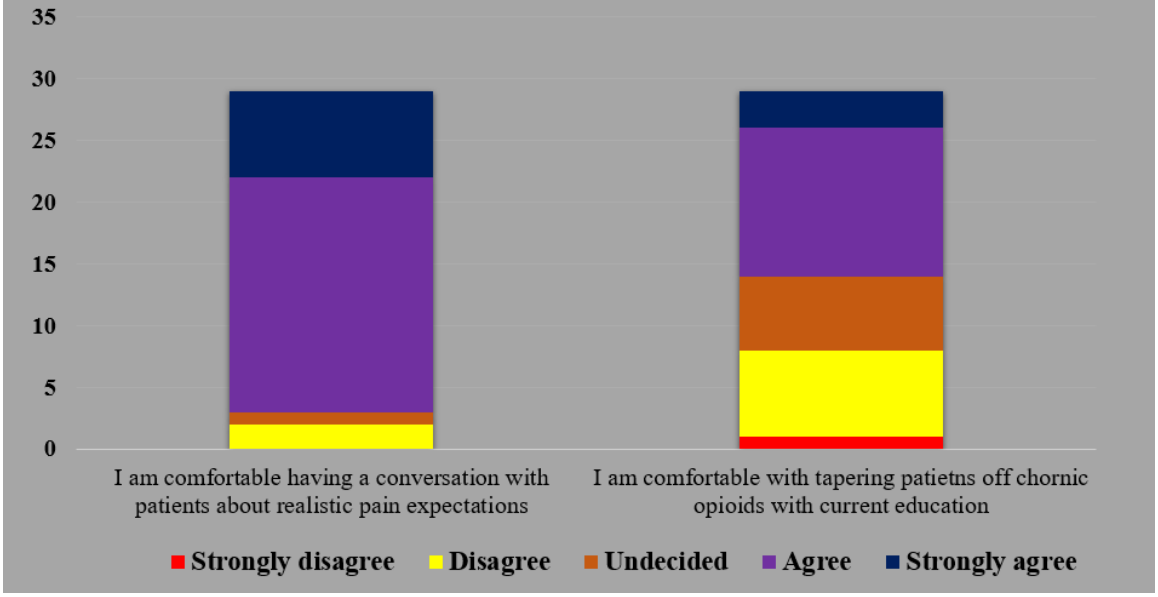
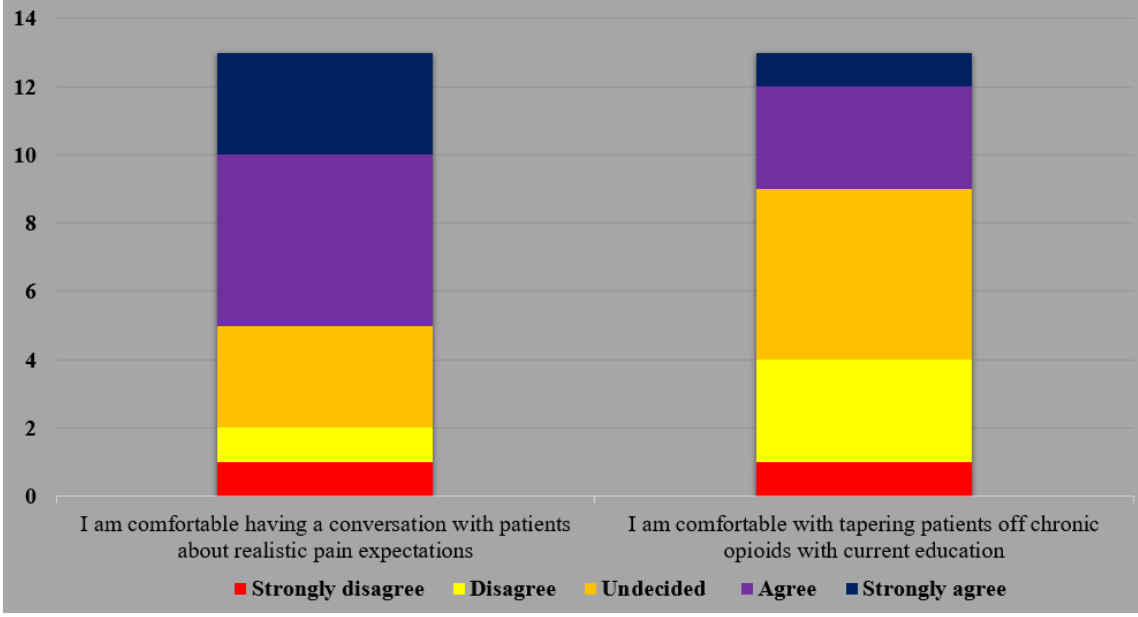


Figure 19: The level of agreement participants in the first Grand Rounds had regarding conversations with patients.



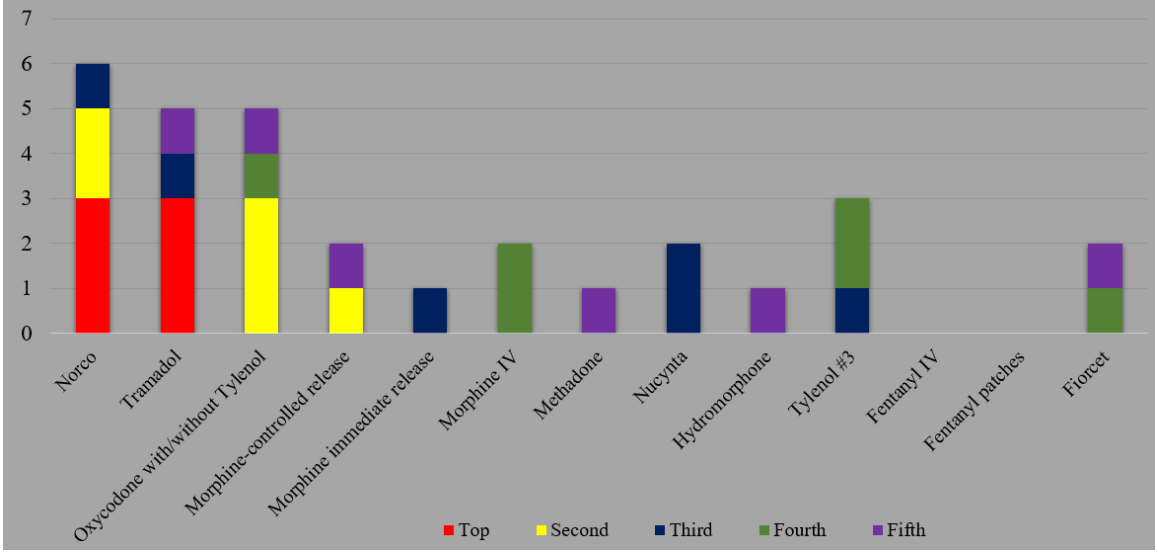
Another interesting fact from both surveys was that healthcare providers and nurses were willing to taper opioids with their current education making it a lower need for education provided in the Grand Rounds (see figures 18 and 19). Initially it was believed that there was a deficit in this area that needed addressed in the second session. Because of the results from both the Facebook and first Grand Rounds, it was felt there did not need to be detailed education provided and that mentioning resources was sufficient.

10. What was the current practice among healthcare providers and nurses regarding OIH and opioids after receiving education on OIH?

After providing new education for nurses and reminder education for healthcare providers and pharmacists in the first Grand Rounds regarding MME with specific opioids and how they transferred over, Norco was still the top opioid likely to be utilized in the participants' practices at 50% (*N = 3*), and it remained one of the top choices selected for the second and third opioid likely to be utilized in practice (see Figure 20).

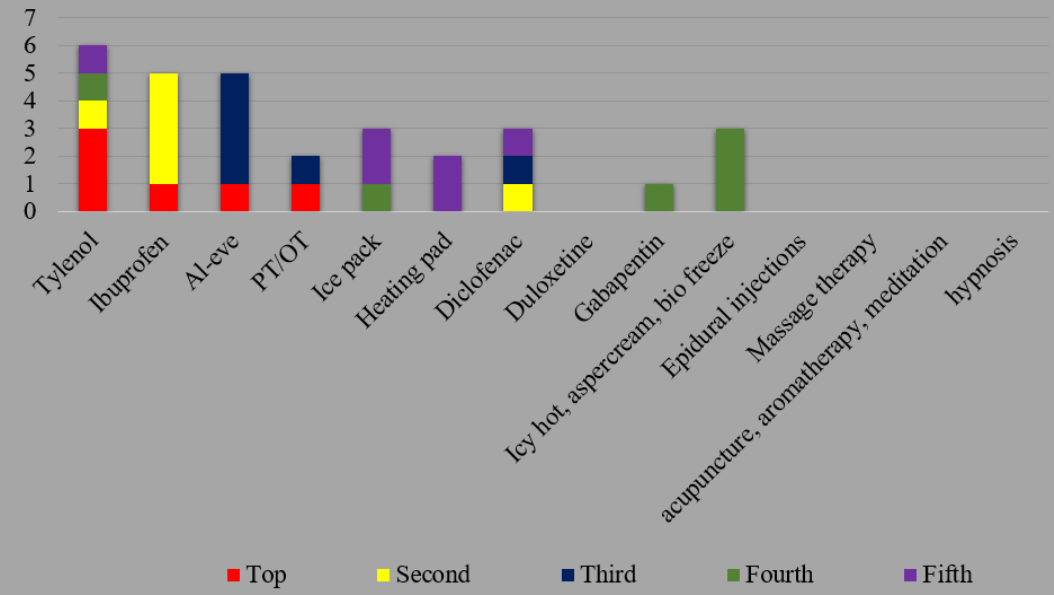
This indicated the MME chart may not have been as well interpreted as initially thought based on individual comments made to the presenter in conversation. It is promising that tramadol was tied with Norco as the top opioid that will likely be utilized in practice, giving the researcher some hope that some of the information provided on the MME conversion chart was processed appropriately to keep the MMEs taken by patients at a minimum.

Figure 20: The top five opioids the participants are likely to utilize in their practice after the first Grand Rounds.



When it came to what alternative analgesics participants were most likely to utilize in their practices after receiving education, oral NSAIDs including Tylenol were the most frequently selected ones (see Figure 21). Surprisingly, topical analgesics were not selected by participants as methods they were likely to utilize in practice. Even recommending the use of an ice pack or heating pad did not score higher after receiving education. Those options did at least reach the top five after education (see Figure 21). This suggests that providers did consider topical analgesics more than they did before the educational intervention, but not a much higher rate.

Figure 21: The top five alternative analgesics participants are likely to utilize in their practice after the first Grand Rounds.

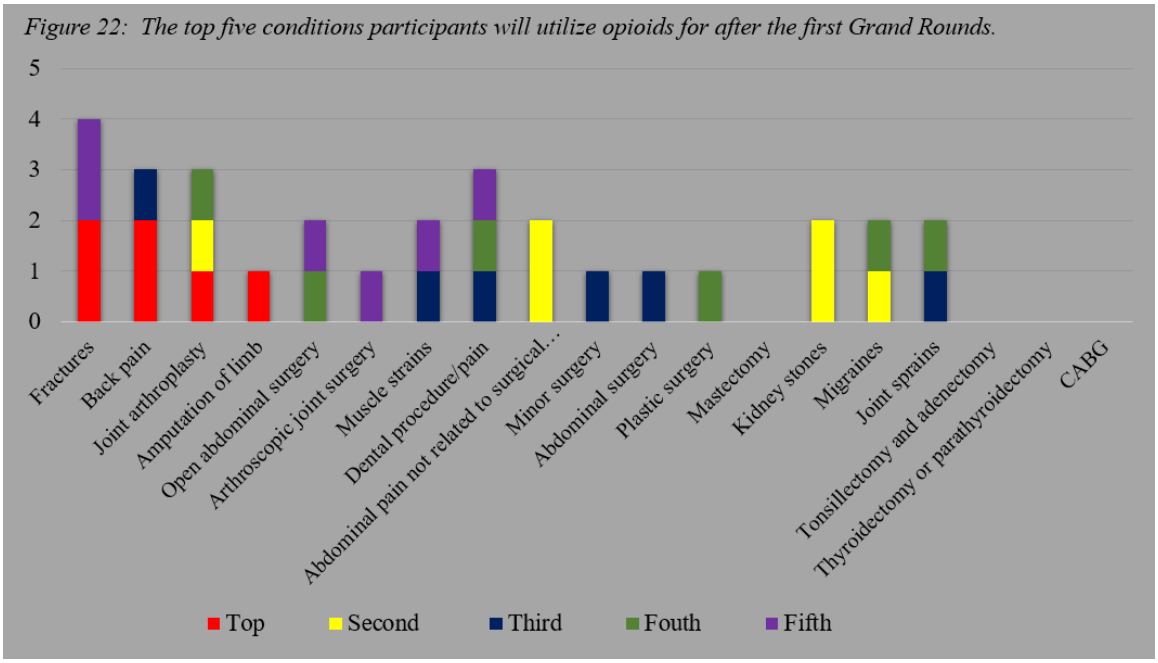


During the second Grand Rounds, the participants were asked in an anonymous poll what they believed would be the best benefit of using a topical NSAID. Only three participants answered the question, but all of them recognized the benefit of the topical NSAID used for pain. Even though the roster consisted mostly of the same people, not all attended the first session, so it was unclear if these respondents needed the education about the first pass effect and use of topical medications to bypass it. This also may have been the result of some participants doing some research on their own regarding alternative analgesics as it was discussed briefly in the first Grand Rounds session as a potential way to decrease the risk of developing OIH and as a treatment method for patients with OIH.

After education, fractures were no longer the sole top conditions participants were likely to utilize opioids for (see Figure 22). Open abdominal surgery was tied with fractures for the top reason, and fractures did not appear again until the fifth reason. This

suggests more care will be utilized by the healthcare providers in using opioids, and alternative medications for pain would be utilized first. Abdominal pain and kidney stones were the second reason opioids would most likely be utilized in practice, suggesting that there needed to be some education regarding other pain relief options. There was not any clear answer for the third and fourth reasons opioids would be utilized in practice, making it unclear whether pathophysiology of several conditions needed to be discussed in the next Grand Rounds or if there needed to be a stronger emphasis placed on chronic meds taken that can also reduce pain. There was not anything selected as the sixth reason due to when the question was set up it only required the top five reasons to be answered prior to continuing.

Figure 22: The top five conditions participants will utilize opioids for after the first Grand Rounds.

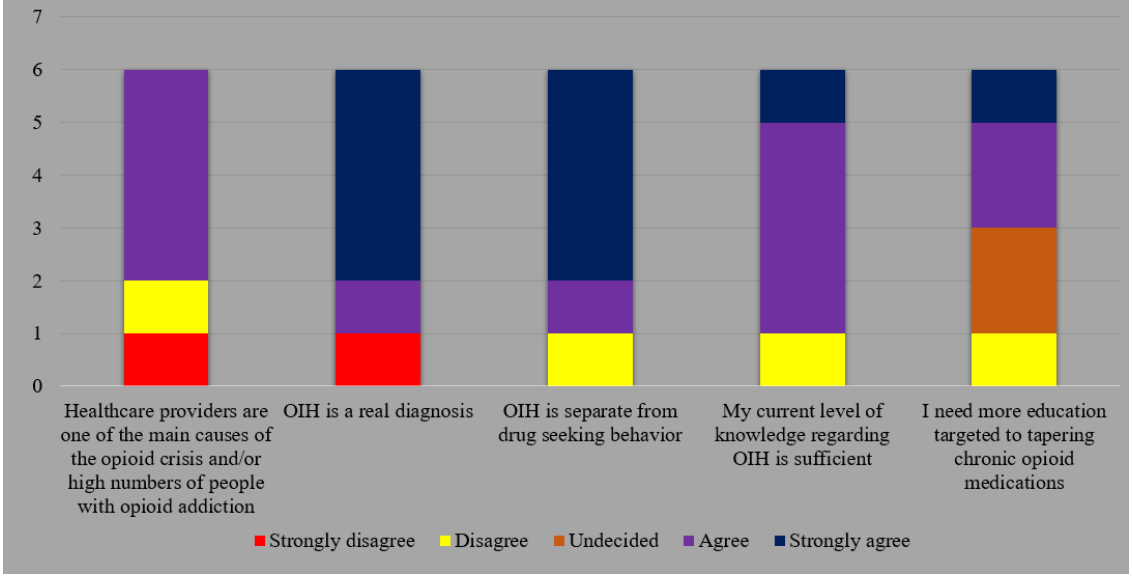


11. What were the beliefs and attitudes among healthcare providers and nurses regarding OIH and opioids after receiving education on OIH?

There was improvement after the educational intervention in participants recognizing that OIH is separate from drug seeking behavior and that it is also a real

diagnosis (see Figure 23). There was a slight improvement of knowledge regarding OIH after education; however, there continues to be a knowledge gap. As there was only one hour allowed for each Grand Rounds, it is likely that there was too much information regarding the pathophysiology of OIH for participants to comprehend. There continued to be an overall agreement that healthcare providers were one of the main causes of the opioid crisis and/or high numbers of people with opioid addiction despite the discussion of the changes promoted by pharmaceutical companies in the 1990's according to the post-session survey (see Figure 23). There may have been too much information during the session for participants to decide whether they were a main cause or not. This may be because providers do not have to prescribe medications based on what the companies tell them and use their best judgement instead. The need for more education targeted to tapering chronic opioid medications remained a need for providers post education, suggesting that this should be included in the second session. As there were not enough respondents for the pre- and post-surveys for the second Grand Rounds presentation, it is difficult to determine whether the education provided was beneficial or continued to need some adjusting.

Figure 23: The level of agreement participants had with the following statements regarding OIH, opioids, and tapering after the first Grand Rounds.



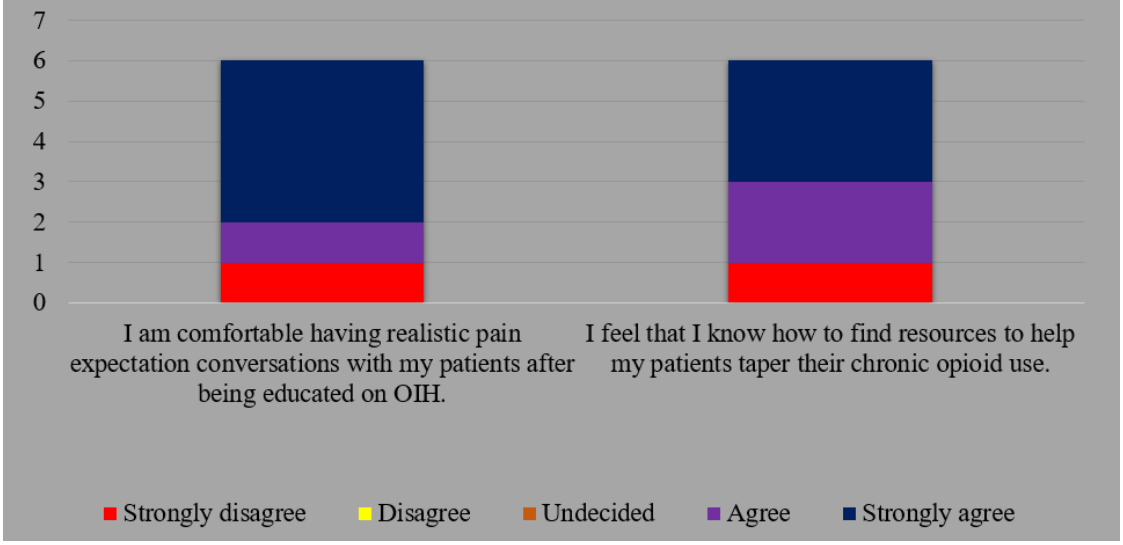
The use of alternative analgesics instead of opioids continued to be difficult for providers to fully commit to after education. While the pre-education survey showed that participants would utilize alternative analgesics in their practice, the answers in the post-education survey showed they were equally divided over three responses. In the first Grand Rounds there was not much discussion over the types of alternative analgesia other than to utilize them to help with OIH prevention and treatment. During the second Grand Rounds more discussion was held regarding the benefits and usage of alternative analgesics. The information that was introduced was generalized with emphasis on the poll question regarding beliefs about whether alternative analgesics work better on pain instead of opioids. The answers were based on percentage of times the participant believed alternative analgesics worked. According to that poll, there was only one person who answered 26-50% likely believed alternative analgesics worked better than opioids and two answered 51-75% likely believed alternative analgesics worked better than opioids. Some education was provided regarding different prescription medications and

supplements that can be given for treatment of chronic pain in the second Grand Rounds, but due to lack of participants in the post-survey, evaluation of the data was not possible.

12. Were healthcare providers and nurses comfortable communicating with patients about pain management after receiving education on OIH?

Before and after Grand Rounds, participants were comfortable having a conversation with their patients about realistic pain (see Figure 24). The area that had changed after education regarding this topic was that no one was undecided or disagreed with having that conversation showing that the education did have an impact with the participants more comfortable with this conversation. Despite more participants expressing comfort with having pain expectation conversations with their patients post educational intervention, there was still a single participant who strongly disagreed. While there was a single participant who strongly disagreed prior to the educational intervention, it was felt that it was possibly due to a lack of understanding the importance of having that conversation. As there was still a participant that strongly disagreed, it is possible that there was too much information provided during Grand Rounds and the participant did not understand why it was so important. Another reason is because the participant may not wish to have those conversations with patients regardless of their importance.

Figure 24: The level of agreement participants had with statements regarding patient conversation and tapering opioids after the first Grand Rounds.



Another interesting finding was that the level of comfort participants had regarding their knowledge on how to find resources to help taper chronic opioids. There was a total of eight participants who were either undecided or disagreed they were comfortable tapering opioids before the educational intervention. Surprisingly, after the educational intervention, no participants disagreed or were undecided regarding whether they knew how to find help tapering chronic opioids (see Figure 24). Even though the purpose of the education was not to focus on how to taper opioids during Grand Rounds, the information presented allowed participants to feel more comfortable with obtaining resources to assist patients decreasing their chronic opioid use, decreasing their total daily MMEs, improve their overall quality of life, and to assist in treating and/or preventing OIH. This finding displayed that the education given was helpful to participants.

Summary

Because there were not enough participants in the post-session surveys given at the end of the second Grand Rounds or for a follow up survey, it is unclear whether the

education was beneficial for all participants. The data did show that there was some improvement on the knowledge of OIH, how to prevent it, and how to treat it. Initially most participants believed it was a form of tolerance. Because there was only one email provided by a participant for the post intervention survey, no post intervention survey was completed, so it is unknown whether retention of the material presented was sufficient. For the public, on the Facebook survey 75% (*N = 67*) were unable to correctly identify the correct definition of OIH, 77% (*N = 10*) of providers were unable to select the correct definition of OIH pre-session, and on Facebook 65% (*N = 19*) of providers believed it was due to opioid tolerance.

While the majority of participants were unable to correctly define what OIH was, they did believe it was real and separate from tolerance. This could possibly be due to the researcher asking both questions in the same survey might have prompted the participant to answer differently. It was not felt to be secondary to searching for the definition of OIH on Google or another search engine after they defined OIH.

Consistently through all surveys, all participants indicated they were comfortable with having realistic pain expectation conversations with the other group. While this appears promising, the reality is that the conversations are not occurring which increases opioid usage and risks of developing OIH, among other problems. Every person will deal with pain at some point in their lives and will need methods to relieve the pain. If realistic conversations are not occurring, especially about when someone should take medication for pain or how long they will hurt post procedures before being “pain free,” then medications will be over utilized.

Even after the educational intervention, there was still a barrier when it came to the use of alternative analgesics and whether they would indeed work for treatment of chronic pain. While initially the participants mostly agreed or strongly agreed they would work and utilize alternative analgesics in their practice, the post-session showed they were split among three answers, although the majority still believed they would with the intention to utilize them in their practice. It is possible that more education would resolve this issue.

CHAPTER V

Discussion

Relationship of Outcomes to Research and Observations

The intention of this project was to educate healthcare providers, nurses, and the public about OIH. The focus of education was on the causes of OIH, predisposing factors, how to treat patients with OIH, preventative methods, and alternative analgesia to recommend or implement for all levels and groups. Additional education provided was some MME conversions, information on finding resources to help patients with opioid addiction and how to taper opioids.

Demographics

For the Facebook survey, after all participants verified they were older than 18 years of age, they were separated into two different groups after specifying whether they were a healthcare professional with a license to administer, prescribe, or dispense opioids. The survey had a 79.2% rate of completion. Some reasons for participants not completing the survey include some questions not being set up properly not allowing participants to answer truthfully, the background color being too bold as it was red initially, and/or the overall length of the survey. The public had a completion rate of 92.7%, so the somewhat low percentage (85.3%) of completed surveys by healthcare workers may be because the healthcare providers and nurses did not correctly read the

defining question about restrictions on their license to practice and being placed into the public's portion of the survey. Out of 45 healthcare worker participants, 16 (35.6%) of healthcare professionals answered their license was not free of restrictions or active and were moved to the public survey for data collection.

The education was given via two Grand Rounds Zoom meetings to healthcare providers, nurses, and other healthcare workers at Labette Health. When both Grand Rounds were held, the hospital census was elevated because of COVID-19, causing fewer people to be available. If hospital census had not been as elevated, there may have been more participants available for either or both sessions that may have provided more significant data with larger numbers. Additionally, information about both sessions was sent to the Irene Bradley School of Nursing at Pittsburg State University for additional participants with a few more participants.

Patient knowledge, attitude, and beliefs about OIH before education and opioid usage

The only data regarding defining OIH was from the Facebook survey. What was found that only 25% of participants were able to correctly select the definition of OIH, while many wrong selections believed it was equivalent to opioid tolerance.

Participants top reason for opioids to be prescribed was fractures at 66% with the second through fourth reasons being abdominal pain due to kidney stones at 53%, lower back pain at 43%, and headache including migraines at 41%. Lower back pain made an appearance in every level, suggesting that there was ample room for education on the nature of lower back pain and how to appropriately treat it needing to come from providers when seeing patients with these complaints. A concern was that headaches, including migraines, were the fourth top reason for opioids to be utilized. This shows

that education needs to be given by the healthcare provider or nurse about how migraines are not resolved with opioids as the opioid does not correct the problem causing the pain.

The patients' usage of opioids was evaluated three ways in the Facebook survey. Initially they were asked with what frequency the participants saw a healthcare provider for opioids in the previous 6 months including phone calls. Most of the responses indicated that they did not see a provider, 96% reported 0-2 face to face visits, and 34% reported making 0-5 calls to the office. The second question asked the frequency per week the participants took opioids, with 92% saying they did not take any. The final way the survey attempted to gauge opioid usage by patients was by asking how many pills per dose the participants used with a liquid conversion to pills defined in the question. The majority, 83%, answered they did not take any opioids, but 16% answered they took 1-2 pills per dose. The question was not properly set up prior to publishing it, so there were concerns voiced via email by participants that they were unable to select no opioids initially because the option was not present. It was fixed after publishing, so it is likely that some of the respondents who answered they did take opioids should have been in the no opioids group, but the majority of participants still responded that they did not use opioids. These results were not expected as there has been a high level of opioid patients seen in practice in the target area. A couple of possible causes for this result are because 83% of the participants were college graduates because the population of the survey may have been influenced by how it was shared on Facebook. This resulted in a much larger radius of participants than the target area, but valuable results were received.

Patients after receiving education on OIH

There were no participants in the educational sessions for the public on either date, so no data was collected.

Healthcare providers and nurses before education

As with the public, healthcare providers and nurses were unable to correctly define OIH; and 66% of the Facebook survey respondents believed it was secondary to tolerance as did 76.9% of Grand Rounds participants. This emphasized the need to provide education so more awareness about OIH could be provided, including how it differs from tolerance. It was interesting though that 76% of Grand Rounds participants believed that OIH was separate from tolerance, but the majority thought OIH was secondary to tolerance.

According to the Facebook survey, 52% utilized opioids of some type in their practice within the previous six months. The top opioid utilized in practice was hydrocodone, with tramadol being the second choice. In the pre-session survey, hydrocodone remained the top opioid utilized, and tramadol again was second. The third opioid utilized was hydromorphone and likely more indicative of acute care participants. It was not expected to rank that low due to belief that more inpatient nurses would have time to participate in the Grand Rounds. As it was likely for nurses to not have knowledge about MME conversions for opioids, that information was not asked.

For both Facebook and Grand Rounds surveys, more than 70% of participants were either undecided or disagreed about how to taper opioids. While the majority of Facebook survey participants were unable to provide the correct definition of OIH, there were 79.6% that believed it was a real diagnosis, and 65.6% believed it was separate from drug seeking behavior. Similarly, 84.6% of Grand Rounds participants believed OIH was

real, and 92.3% believed it was separate from drug seeking behavior. This result could be due to having the three questions on the same survey suggesting to the participant that OIH is not only real but also separate from drug seeking behavior, causing a discrepancy in the answers between them. Not surprisingly survey participants overwhelmingly felt like their knowledge regarding OIH was sufficient. Neither group of participants had a majority of participants believing they had enough knowledge to taper chronic opioids and needed more education.

While healthcare providers are typically blamed by many as the main cause of the opioid crisis, they are not the root of the cause. It is true that they are the ones patients receive opioids from, but they also were told by pharmaceutical companies that patients would not become addicted to the medications and were encouraged to increase their opioid utilization in practice. Despite this fact, per the Facebook survey for healthcare providers and nurses, when asked if they agreed healthcare providers were one of the main causes of opioid crisis, 37.9% were undecided; 41.9% agreed; and 3.5% strongly agreed. Per the Grand Rounds survey with the same question, 7.7% were undecided and 69.2% agreed they were one of the main causes. It is difficult to determine if this is how they honestly feel on their own, or if they are accepting more responsibility for their role in the opioid crisis and trying to help fight the problem their predecessors have created.

Healthcare providers and nurses knowledge, beliefs/attitudes, and intent after education

Because only one person left an email address for a follow up survey, the data used for this is only from the first Grand Rounds presentation. There was only one

participant in the post-session survey after the second Grand Rounds presentation so none of that data was used because of bias.

There was a tie between hydrocodone and tramadol for the top opioid participants intended to utilize in their practice. This suggested that the information regarding MME conversions was a useful addition to the information on the pathophysiology of OIH education. Unfortunately, though, oxycodone was the second opioid participants intended to utilize in their practice, making it appear less likely that the material was retained and as though too much information may have been presented at one time. NSAIDs remained one of the categories of alternative analgesics providers were most likely to utilize in practice.

After education, participants appeared more comfortable with OIH knowledge, as only 16.7% believed they needed more education on OIH. Similarly, participants increased their belief that OIH was different than drug seeking and its own diagnosis. Unfortunately, however, 66.7% continued to believe that healthcare providers were one of the main causes. It remains possible they have been influenced by predecessors or their own personal beliefs as to how significant of an impact the positions have had and will continue to have with opioids. There was not much information given during the educational intervention on the overall culture of the American population who tend to believe there is a pill for every ailment and they should never hurt. Information regarding pain management should be given during conversations between healthcare professional and patient prior to the usage of opioids.

Information was given to participants that there are benefits to utilizing alternative medicine approaches for pain relief including medications and techniques in generalized

format, 66.7% agreed or strongly agreed that not only did they intend to utilize alternative analgesics in their practice, but they believed alternative analgesics would work in relieving pain, including chronic pain.

After the Grand Rounds, only 16.7% were not comfortable having realistic pain conversations with their patients and they knew how to find help for patients to taper their opioid usage. While there was not much information given during the first Grand Rounds about tapering opioids, it is possible that participants had information from additional resources education. Additionally, it also could have been that participants had not given much thought into tapering a patient's opioids to prevent a worsening of their condition because of said opioid.

Observations

Surprisingly, there was not much published information on education being given to anyone specific, just only supporting the finding of OIH and some guidelines on how to diagnose it so there were no templates to follow or improve upon. Frequently utilized medications for acute patients, hospitalized or not, that are more likely than not to have an elevated risk of causing OIH were mentioned in the literature, but that is not a commonly known risk associated with their usage. Because there is not much information published regarding educational programs for healthcare professionals about OIH and the fact that this study proved that there was a significant knowledge deficit for everyone regarding OIH that did improve with education, it is reassuring that the information was received and interpreted positively.

There were some problems with the surveys established on SurveyMonkey as some questions were not set up appropriately with forced answers. The Facebook survey

had a question that did not allow using the same column more than once, and another question that did not leave an option for not taking opioids. Both questions were fixed after some answers were collected, but it is felt that this technical issue did not have a significant impact on the overall results. Another issue with the Facebook survey was a request being made indirectly to the creator to change the color as the red background was too strong on the eyes. It is possible that there were other participants that had the same issue and did not finish the survey.

The survey given before the initial Grand Rounds did have some questions that were not set up correctly on SurveyMonkey. One problem was that the ranking of at least one question was not set up to rank the specified number of selections, but instead to have ranked all selections. A suggestion was received to have a couple different options regarding opioids and either not seeing patients with this diagnosis or do not prescribe. Because there were issues with the first two surveys noticed after publishing them, future surveys were checked for content validity and function. Even though function was checked with the first Grand Rounds post survey, the question asking about the top six conditions opioids with be utilized in practice was set up to only rank the top five.

The COVID-19 pandemic had a significant impact on how this study was done and the timeline in which it took place. Initially the education was going to be provided earlier in the year for both groups, prior to the summer, in an attempt to collect data in what was felt to be a higher accidental injury time related to recreational activities. Because of the pandemic, social distancing, and other recommendations, all education had to be delayed until later in the year, with the education provided in a virtual classroom format. Even though the target area did not experience a high impact earlier in

the year, when education was given, it was during a higher hospitalized patient census which likely prevented more healthcare professionals from attending. Even the public sessions would likely have had participants if they were to have happened when initially intended, but when they did occur, it was over winter break for schools and near the end of the year.

In the first Grand Rounds there were no poll questions given, making it difficult for immediate determination of how well the presented information was received. Because of this, it was decided to have poll questions in the second Grand Rounds to allow the researcher to address questions in the moment and also how in depth the information needed to be. There were not as many participants in the second session, and even fewer who participated in the polls. It might have been that participants were not actively listening and watching the presentation but had logged in solely for the continuing education credit.

The target public population was not responsive to education despite advertisements of gifts to be awarded through drawings. The advertising in the paper was provided by Labette Health, and they also utilized their Facebook page to promote the education. Despite several shares on Facebook and days of advertising in the paper, there was not any participation from the public even though they could attend in person with social distancing and mask regulations being followed.

Evaluation of Theoretical Framework

Martha Rogers' Theory of Unitary Human Beings was selected for this project. That Rogerian approach focused on multiple aspects of a person's life having a direct influence on their well-being and how each aspect will affect another. This project

focused on more than one aspect of influencing others, including the person's overall well-being.

Evaluation of Logic Model

The logic model used for this study was based on level of importance to the study. This study was to provide education regarding OIH, increase opioid awareness, and alternative analgesia with proof provided on a follow up provider survey evaluating both groups. While the follow up survey did not happen and public education did not occur, there was an increase in knowledge noticed after the first Grand Rounds presentation.

Not all the outcomes could be determined either because the public was not educated, so there is not a way currently to determine whether they can verbalize realistic pain expectations or appropriate usage of opioids or alternative analgesics based on their pain. Naloxone use is routinely monitored by Labette Health and there is a concern for accidental overdoses inside and outside the facility. Naloxone usage inside Labette Health has decreased because of education to nursing and medical staff plus there has been a decrease in intravenous opioid orders for patients along with alternative analgesics. Naloxone usage outside of the facility is currently unknown at this time compared with prior to this study.

Limitations

External factor limitations

The cost of educational material was not significant as KU-AHEC and Labette Health were willing to sponsor the sessions. The material presented in the Grand Rounds was a prelude to KU-AHEC's upcoming opioid awareness series for healthcare providers and nurses. This allowed them a chance to promote their series essentially as a

continuation of the material presented on OIH. Surveys and provided education did have to be fully online, creating an issue for some because of lack of reliable internet to adequately view and participate in the appropriate educational session.

The biggest issue aside from the pandemic was making the arrangements for the education to be given to healthcare providers and nurses. It was difficult to make contact with an initial person at KU-AHEC after IRB approval was given. As a result, once the lockdown restrictions were being slowly lifted, an alternate contact person was given by Labette Health and the sessions were established. Because the arrangements were being made to present during the monthly Grand Rounds provided by KU-AHEC and Labette Health, previously arranged presenters were scheduled until the last part of the year and left little room for this educational presentation prior to then.

Instrument limitations

There are two limitations that are believed to have discouraged participation. One is the internet – both lack of access and lack of reliability. This was true not only for the public but for providers as well. The other is to have problems with utilization of SurveyMonkey and surveys not having been set up correctly in the beginning, requiring them to be fixed after data had been collected and potentially skewing some data.

Sample limitations

The initial target group was to be of providers, nurses, and the public in the four-state area, especially in southeast Kansas. Because there was not much published literature regarding education about OIH, a Facebook survey was used to determine general knowledge on the topic in order for the researcher to determination how much material would be presented for the initial attempts made to educate and provide

awareness of OIH. The Facebook survey allowed for people outside the target area population to participate; however, it was felt the benefits outweighed any negatives so education could be appropriately designed.

Even though KU-AHEC and Labette Health allowed the usage of their Grand Rounds sessions for November and December 2020, the COVID-19 pandemic caused an increased hospital patient census that necessitated higher staffing and decreased available participants. The COVID-19 pandemic created social distancing guidelines that included utilization of masks and mandatory decreased availability for seating in conference rooms to help mitigate the spread. Because of these restrictions and continued psychological strain on everyone, it is likely that it created an unintentional barrier for the public to attend education both online and in person. The follow up provider survey and both surveys from the second Grand Rounds were not included in the results, as all only had a single respondent, thereby creating a sample bias in the data.

Implications for Future Research

There remains a strong need to educate the public about OIH, and there could be more defined education given to specific groups of healthcare providers and nurses. The public never received education, so a further study could start with the basic information regarding OIH, realistic pain expectations, and appropriate use of opioids. This could be provided in various methods, but one consideration would be to provide healthcare providers with pamphlets about OIH for their waiting rooms that patients can take with them. As the providers have already been educated, they should have enough knowledge to answer basic questions about OIH, what that patient's risk factors are, and how to modify their care to maximize health without high doses of opioids.

Another problem is how well healthcare providers and nurses interpreted the material they were given, passed it on to others, and have adjusted their practices regarding opioids. This is an area that can be addressed in a future study that would allow for more targeted education being given to all healthcare workers, with increased potential for higher levels of collaboration between departments or medical specialties.

Implications for Practice, Policy, and Education

The educational need discovered by this project displayed a potentially dangerous knowledge deficit that has high levels of catastrophic consequences. As this study showed, there is a lack of knowledge regarding OIH in addition to a lack of communication between patients and healthcare providers and nurses. There needs to be emphasis on communication methods in the education of healthcare providers and nurses as the patient is reliant not only on their families but also on their trusted healthcare provider. Education on MME needs to have a stronger force in advanced practice, especially where to get the latest MME conversion table and recommendations prior to graduation. This could be given during a separate mini class or as part of a pharmacology class. While nurses are not trained to prescribe, it is still important for them to realize how easily MMEs will accumulate based on specific medications given. There should be material provided by the facilities for nurses so they will realize how something as simple as hydrocodone, that many have voiced they do not view as a bad medication, translates to a specific amount of morphine per tablet.

Practice changes need to include a greater level of accountability for healthcare providers and nurses when opioids are given. Again, nurses do not prescribe medications, but they are giving opioids and encouraging their usage in multiple areas of

practice without considering the significance of the consequences and side effects of opioids past overdose or constipation. The creation of a software update to electronic health records or a job specifically dedicated to monitoring the MME administered or prescribed by a facility's providers and nurses so patterns can be found, monitored, and corrected as needed.

Changes to policy are more difficult to create. Ultimately the goal would be to have a drastic decrease in opioid prescriptions, decrease in daily MME usage, and more alternative analgesics utilized. A method to do this would be to create mandatory facility MME reporting and transparency of opioid safety problems. The safety problems to be reported should include the frequency of accidental overdoses and adverse effects directly related to them. Interfacility monitoring should be implemented, with policies established for education and counseling for elevated MME rates after an adequate evaluation of the type of patients included in the employee's care for that period to ensure it is not justified.

All levels of healthcare providers and nurses should be educated on MME conversions relevant to their level of practice. More information should be given, including education about how the rapid speed MME can add up to with a single or multiple dose, the consequences of that level of MME, and how to monitor for OIH and other opioid induced conditions that will occur. After incorporation of all conditions that opioids can induce, not just OIH, into the education of healthcare staff, then increased awareness and practice adjustments will occur. As adjustments from healthcare staff are made, education from them to the public will occur more frequently, and the public will

have a better chance at avoiding potentially disabling conditions related to conditions caused specifically by opioid usage regardless of their duration.

Conclusion

This study evaluated the current knowledge of healthcare providers, nurses, and public regarding OIH and then provided education to healthcare providers and nurses. The majority of participants were unable to accurately define OIH prior to education, public was more likely to use opioids for conditions that did not necessitate their use and had increased MME usage and/or recommendation. After the providers were educated, improvement was made in decreasing the total MME for the top opioid utilized and a change in the frequency of conditions that opioids would be utilized for. Because of this study, more awareness towards opioid use consequences past constipation and addiction has occurred, and there is a possibility of better patient education on how and when to utilize opioids including appropriate conditions.

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APPENDIX

Appendix A

Opioid Induced Hyperalgesia Initial Survey

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia. This survey will assist in evaluating the education needs for healthcare providers and the public. This survey should take about 10 minutes to complete and your answers will be confidential. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP scholarly project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Age
    a. 18-29 years
    b. 20-29 years
    c. 40-49 years
    d. 50-59 years
    e. 60-69 years
    f. 70 years and above

2. What gender do you identify yourself as?
    a. Male
    b. Female
    c. Prefer not to answer

3. What is your highest level of education?
    a. Did not graduate high school
    b. Graduated high school or GED
    c. Some college but no degree
    d. Vo-tech training
    e. Associate degree
    f. Bachelor's degree
    g. Master's degree
    h. PhD
    i. Practice doctorate
    j. None of the above
    k. I prefer not to answer

4. What is your current profession?

a. Physician
b. Physician assistant
c. Pharmacist
d. Registered nurse
e. Nurse anesthetist
f. Clinical nurse specialist
g. Nurse practitioner
h. Licensed practical nurse
i. Nurse midwife
j. Healthcare educator
k. I am not a licensed healthcare professional (certifications do not count)

5. Please select the definition of opioid induced hyperalgesia. Please do not use Google)

a. An elevated pain response to an injury or chronic condition
b. An elevated pain response because of opioid tolerance
c. A response to pain sensation caused by an elevated or chronic opioid use
d. A condition where opioids do not work on pain so there is no pain relief

6. Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

Public participant beliefs regarding opioids.					
Opioids are the first drugs to be used in the treatment of pain	1	2	3	4	5
I am comfortable having a realistic pain expectation conversation with my healthcare provider	1	2	3	4	5
I know how to find help for opioid related problems other than using Google	1	2	3	4	5

7. Rank the top 4 reasons you believe opioids should be prescribed, excluding surgeries, with 1 signifying the top reason.

a. Headache, including migraines
b. Lower back pain
c. Broken bones
d. Middle back pain
e. Sprained joint
f. Joint pain not due to injury, including arthritis
g. Upper back pain

h. Abdominal pain due to kidney stones
i. Abdominal pain due to other causes excluding surgeries in the last 6 months
j. Muscle aches
k. Abdominal pain due to cramps

8. Select the top 4 non-prescription medications you believe are best for pain relief with 1 signifying the top reason.

a. Heating pad
b. Ice pack
c. Lidocaine (non-prescription strength)
d. Motrin or ibuprofen or Advil
e. Tylenol or acetaminophen or paracetamol
f. Bio freeze
g. Diclofenac
h. Al-eve or naproxen sodium
i. Aspercream gel or patches
j. Icy Hot

9. How frequently have you seen a healthcare provider to obtain a prescription for opioids in the last 6 months? Calls for chronic or short-term opioid refills and initial calls for new opioid requests are included. Select all that apply.

a. 0-2 face to face visits
b. 3-5 face to face visits
c. 6-10 face to face visits
d. 11-20 face to face visits
e. 21-30 face to face visits
f. More than 30 face to face visits
g. 0-5 calls to office
h. 6-10 calls to office
i. 11-20 calls to office
j. 21-30 calls to office
k. More than 30 calls to office

10. Select the frequency that you take opioids per week. This includes ALL opioids taken as individual times.

a. 1-10 times
b. 11-15 times
c. 16-20 times

d. 21-25 times
e. 26-30 times
f. 30 times
g. I do not take opioids

11. How many pills do you take per opioid dose? If you take liquid opioids, consider the lowest amount you are supposed to take as a pill.

a. 1-2
b. 2
c. 3
d. 4
e. More than 5
f. I do not take opioids

12. Is your healthcare license to administer, dispense, OR prescribe opioids active and without restrictions?

a. Yes
b. No

13. What clinical area do you primarily work?

a. Clinic
b. ER
c. PACU
d. ICU, all types
e. Medical-surgical; includes cardiac and step-down units
f. Obstetrics
g. Pediatrics
h. Skilled nursing facility or unit
i. Long term acute care hospital
j. EMS
k. Outpatient pharmacy
l. Inpatient pharmacy
m. Inpatient rehabilitation unit
n. Substance abuse facility
o. None of the above

14. How many years have you been in your current healthcare licensed profession?

a. 0-5 years
b. 6-10 years
c. 11-15 years
d. 16-20 years
e. 21-25 years
f. 26-30 years
g. > 30 years

15. Select the definition of opioid induced hyperalgesia. (Please do not use Google)

a. An elevated pain response to an injury or chronic condition
b. A diagnosis used by chronic pain patients to receive an increase in dosage or type of opioid
c. An elevated pain response secondary to opioid tolerance
d. A response to pain caused by an elevated or chronic opioid use

16. Rank the top 5 opioids administered/prescribed/dispensed in your practice with 1 signifying the most frequently prescribed/administered/dispensed.

a. Oxycodone
b. Tramadol
c. Percocet or oxycodone with acetaminophen
d. Morphine-controlled release
e. Morphine IV
f. Fentanyl IV
g. Fentanyl patches
h. Norco or hydrocodone with acetaminophen
i. Tylenol #3 or acetaminophen with codeine
j. Morphine immediate release
k. Hydromorphone

17. Select the frequency percentage of dispensing/prescribing/administering of opioids in your practice in the last 6 months.

a. 0-20%
b. 21-40%
c. 41-50%
d. 51-60%
e. 61-70%
f. 71-75%
g. 76-80%

h. 81-90%
i. > 90%

18. Rank the top 5 alternative analgesics that you prescribe/administer/recommend to your patients with 1 signifying the most recommended/prescribed/administered.

a. Neurontin or gabapentin
b. Lidocaine (non-prescription strength)
c. Ice pack
d. Physical or occupational therapy
e. Heating pad
f. Al-eve or naproxen sodium
g. Cymbalta or duloxetine
h. Icy Hot
i. Aspercream gel or patches
j. Bio freeze
k. Diclofenac
l. Tylenol or acetaminophen or paracetamol
m. Motrin or ibuprofen or Advil
n. Epidural injections
o. Massage therapy
p. Acupuncture
q. Aromatherapy
r. Hypnosis
s. Meditation

19. What would you estimate as the frequency of opioid induced patients you have seen in your practice?

a. 0-20%
b. 21-40%
c. 41-60%
d. 61-75%
e. 76-90%
f. > 90%

20. Please indicate your level of agreement with the following statements using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

Opioid induced hyperalgesia causes and diagnosis

Healthcare providers are one of the main causes of the opioid crisis and/or high numbers of people with opioid addiction	1	2	3	4	5
Opioid induced hyperalgesia is a real diagnosis	1	2	3	4	5
Opioid induced hyperalgesia is separate from drug seeking behavior	1	2	3	4	5
My current level of knowledge regarding OIH is sufficient	1	2	3	4	5
I need more education targeted to tapering chronic opioid medications	1	2	3	4	5

21. Do you believe opioid induced hyperalgesia is separate from tolerance?

a. Yes
b. No

22. Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

Alternative analgesics					
Alternative analgesics work in relieving pain, including chronic pain	1	2	3	4	5
I recommend/administer/dispense alternative analgesics	1	2	3	4	5

23. Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

Conversations with patients and weaning of chronic opioids					
I am comfortable having a conversation with patients about realistic pain expectations	1	2	3	4	5
I am comfortable with tapering patients off chronic opioids with current education	1	2	3	4	5

Appendix B

Opioid Induced Hyperalgesia Healthcare Provider Pre-Education Survey

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia (OIH). This survey establishes your current knowledge of OIH for comparison after education. This survey should take about 10 minutes to complete and your answers will be confidential. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP scholarly project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Age:
    a. 18-29 years
    b. 30-39 years
    c. 40-49 years
    d. 50-59 years
    e. 60-69 years
    f. 70 years and above

2. What gender do you identify yourself as?
    a. Male
    b. Female
    c. Prefer not to answer

3. What is your highest level of education?
    a. Did not graduate high school
    b. Graduated high school or GED
    c. Some college but no degree
    d. Vo-tech training
    e. Associate degree
    f. Bachelor's degree
    g. Master's degree
    h. PhD
    i. Practice doctorate
    j. None of the above
    k. I prefer not to answer

4. Is your healthcare license to administer, dispense, or prescribe active and without restrictions?
    a. yes

b. no

5. What is your current profession?
   a. physician
   b. physician assistant
   c. pharmacist
   d. registered nurse
   e. nurse anesthetist
   f. clinical nurse specialist
   g. nurse practitioner
   h. licensed practical nurse
   i. nurse midwife
   j. nursing educator
   k. physician or physician assistant educator
   l. none of the above

6. How many years have you been in your current healthcare licensed profession:
   a. 0-5 years
   b. 6-10 years
   c. 11-15 years
   d. 16-20 years
   e. 21-25 years
   f. 26- 30 years
   g. > 30 years

7. What clinical area do you primarily work?
   a. Clinic
   b. ER
   c. PACU
   d. PICU
   e. SICU
   f. MICU
   g. CVICU
   h. Neuro ICU
   i. NICU
   j. Express care or urgent care
   k. Medical-Surgical; includes cardiac and step-down units
   l. Obstetrics
   m. Pediatrics
   n. Skilled Nursing Facility or Unit
   o. Long term acute care hospital
   p. EMS

q. Outpatient pharmacy
r. Inpatient pharmacy
s. Inpatient Rehabilitation Unit
t. Substance abuse facility
u. Oncology unit
v. None of the above

8. Select the definition of opioid induced hyperalgesia. (Please do not use Google)

a. An elevated pain response to an injury or chronic condition
b. A diagnosis used by chronic pain patients to receive an increase in dosage or type of opioid
c. An elevated pain response secondary to opioid tolerance
d. A response to pain caused by an elevated or chronic opioid use

9. Rank the top 5 opioids administered/prescribed/dispensed in your practice with 1 signifying the most frequently prescribed/administered/dispensed.

a. _____ hydrocodone with acetaminophen
b. _____ oxycodone
c. _____ oxycodone with acetaminophen
d. _____ morphine-controlled release
e. _____ morphine immediate release
f. _____ morphine IV
g. _____ methadone
h. _____ Nucynta
i. _____ hydromorphone
j. _____ Tylenol #3
k. _____ fentanyl IV
l. _____ fentanyl patches
m. _____ fiorcet
n. _____ tramadol
o. _____ other

10. Select the frequency percentage of dispensing/prescribing/administering of opioids in your practice in the last 6 months.

a. 0-20%
b. 21-40%
c. 41-50%
d. 51-60%
e. 61-70%
f. 71-75%

g. 76-80%
h. 81-90%
i. >90%

11. Rank the top 6 conditions do you most frequently administer, prescribe, dispense (if known) opioids for.

a. ____ fractures
b. ____ abdominal pain not related to surgical procedure
c. ____ minor surgery (port-a-cath insertion/removal, pacemaker, etc)
d. ____ abdominal surgery (laparoscopic, robot assisted)
e. ____ open abdominal surgery
f. ____ joint arthroplasty (total and partial)
g. ____ arthroscopic joint
h. ____ plastic surgery
i. ____ mastectomy
j. ____ amputation of limb
k. ____ partial amputation
l. ____ kidney stones
m. ____ back pain
n. ____ migraines
o. ____ muscle strains
p. ____ joint sprains
q. ____ dental procedure
r. ____ tonsillectomy and adenectomy
s. ____ thyroidectomy or parathyroidectomy
t. ____ CABG

12. What would you estimate as the frequency of opioid induced patients you have seen in your practice?

a. 0-20%
b. 21-40%
c. 41-60%
d. 61-75%
e. 76-90%
f. >90%

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

13. Opioid induced hyperalgesia causes and diagnosis					
Healthcare providers are one of the main causes of the opioid crisis and/or high numbers of people with opioid addiction	1	2	3	4	5
Opioid induced hyperalgesia is a real diagnosis	1	2	3	4	5
Opioid induced hyperalgesia is separate from drug seeking behavior	1	2	3	4	5
My current level of knowledge regarding OIH is sufficient	1	2	3	4	5
I need more education targeted to tapering chronic opioid medications	1	2	3	4	5

14. Do you believe opioid induced hyperalgesia is separate from tolerance?

a. Yes
b. No

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

15. Alternative analgesics					
Alternative analgesics work in relieving pain, including chronic pain	1	2	3	4	5
I recommend/administer/dispense alternative analgesics	1	2	3	4	5

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

16. Conversations with patients and weaning of chronic opioids					
I am comfortable having a conversation with patients about realistic pain expectations	1	2	3	4	5
I am comfortable with tapering patients off chronic opioids with current education	1	2	3	4	5

17. What would you estimate your average MME prescribing/dispensing (does not include administration) rate for patients is in one month?

a. ____ 1-10
b. ____ 11-20

c. ____ 21-30
d. ____ 31-40
e. ____ 41-50
f. ____ 51-60
g. ____ 61-75
h. ____ 76-90
i. ____ >90
j. ____ I do not prescribe or dispense opioids

Appendix C

Opioid Induced Hyperalgesia Provider Post-Education

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia (OIH). This survey will assist in evaluating the education healthcare providers received. This survey should take about 5-10 minutes to complete and your answers will be confidential. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP Scholarly Project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Rank the top 5 opioids that you will likely prescribe or administer after the education provided, with 1 signifying the most likely to prescribe or administer.

a. _____ hydrocodone with acetaminophen
b. _____ oxycodone
c. _____ oxycodone with acetaminophen
d. _____ morphine-controlled release
e. _____ morphine immediate release
f. _____ morphine IV
g. _____ methadone
h. _____ Nucynta
i. _____ hydromorphone
j. _____ Tylenol #3
k. _____ fentanyl IV
l. _____ fentanyl patches
m. _____ fiorcet
n. _____ tramadol

2. Select the frequency percentage you intend to dispense/prescribe/administer of opioids in your practice after receiving the education.

j. 0-20%
k. 21-40%
l. 41-50%
m. 51-60%
n. 61-70%
o. 71-75%

p. 76-80%
q. 81-90%
r. >90%

3. Rank the top 5 alternative analgesics that you prescribe/administer/recommend to your patients with 1 signifying the most recommended/prescribed/administered.

a. ____ Tylenol or acetaminophen
b. ____ Motrin or ibuprofen or Advil
c. ____ Aleve or naproxen sodium
d. ____ Cymbalta or duloxetine
e. ____ Neurontin or gabapentin
f. ____ Icy Hot or Aspercream gel or patches or Bio Freeze
g. ____ Lidocaine (non-prescription strength)
h. ____ Ice pack
i. ____ Heating pad
j. ____ Diclofenac
k. ____ Epidural injections
l. ____ Physical or Occupational therapy
m. ____ Massage therapy
n. ____ Acupuncture or aromatherapy or meditation
o. ____ Hypnosis

4. Select how much your estimation of OIH patients seen in your practice, after receiving education.

a. 0-20%
b. 21-40%
c. 41-60%
d. 61-75%
e. 76-90%
f. >90%

Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

5. Opioid induced hyperalgesia causes and diagnosis					
Healthcare providers are one of the main causes of the opioid crisis and/or high numbers of people with opioid addiction	1	2	3	4	5
Opioid induced hyperalgesia is a real diagnosis	1	2	3	4	5
Opioid induced hyperalgesia is separate from drug seeking behavior	1	2	3	4	5

My current level of knowledge regarding OIH is sufficient	1	2	3	4	5
I need more education targeted to tapering chronic opioid medications	1	2	3	4	5

6. Do you believe opioid induced hyperalgesia is separate from tolerance?

a. Yes
b. No

7. Rank the top 6 conditions you intend to most frequently administer, prescribe, or dispense opioids for.

u. ____ fractures
v. ____ abdominal pain not related to surgical procedure
w. ____ minor surgery (port-a-cath insertion/removal, pacemaker, etc)
x. ____ abdominal surgery (laparoscopic, robot assisted)
y. ____ open abdominal surgery
z. ____ joint arthroplasty (total and partial)
aa. ____ arthroscopic joint
bb. ____ plastic surgery
cc. ____ mastectomy
dd. ____ amputation of limb
ee. ____ partial amputation
ff. ____ kidney stones
gg. ____ back pain
hh. ____ migraines
ii. ____ muscle strains
jj. ____ joint sprains
kk. ____ dental procedure
ll. ____ tonsillectomy and adenectomy
mm. ____ thyroidectomy or parathyroidectomy
nn. ____ CABG

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

8. Alternative analgesics					
Alternative analgesics work in relieving pain, including chronic pain	1	2	3	4	5
I recommend/administer/dispense alternative analgesics	1	2	3	4	5

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

9. Conversations with patients and weaning of opioids					
I am comfortable having realistic pain expectation conversations with my patients after being educated on OIH	1	2	3	4	5
I feel that I know how to find resources to help my patients taper their chronic opioid use	1	2	3	4	5

10. Do you intend to decrease your average MME prescribing or dispensing rate for patients in one month?

a. Yes
b. No
c. I do not prescribe or administer medications

If you would like to be contacted in 3 months, please provide an email address that a link for another survey may be sent to. If you elect to be contacted for follow up and complete the follow up survey your email will be entered into a drawing for a $25 Amazon gift card. Thank you again for your participation.

Appendix D

OIH Healthcare Provider Pre-Education Survey Part 2

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia (OIH). This survey will assist in education needs for healthcare providers. This survey should take about 10 minutes to complete and your answers will be confidential. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP scholarly project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Select your age:
   a. 18-29 years
   b. 30-39 years
   c. 40-49 years
   d. 50-59 years
   e. 0-69 years
   f. 70 years and above

2. What gender do you identify yourself as?
   a. Male
   b. Female

3. What is your highest level of education?
   a. Vo-tech training
   b. Associate degree
   c. Bachelor's degree
   d. Master's degree
   e. PhD
   f. Practice doctorate
   g. None of the above
   h. I prefer not to answer

4. What is your current profession?
   a. Physician
   b. Physician assistant
   c. Pharmacist
   d. Registered nurse
   e. Nurse anesthetist
   f. Clinical nurse specialist
   g. Nurse practitioner

h. Licensed practical nurse
i. Nurse midwife
j. Nursing educator
k. Physician or physician assistant educator
l. Other (please specify)

What clinical area do you primarily work?

a. Clinic
b. ER
c. PACU
d. SICU
e. MICU
f. Express care or urgent care
g. Med-surg; includes step down or cardiac units
h. OB
i. Pediatrics
j. Skilled Nursing facility or unit
k. EMS
l. Outpatient pharmacy
m. Inpatient pharmacy
n. Inpatient rehabilitation unit
o. Quality
p. Nursing education
q. Clinical education
r. Other (please specify)

6. How many years have you been in your current healthcare licensed profession?

a. 0-5 years
b. 6-10 years
c. 11-15 years
d. 16-20 years
e. 21-25 years
f. 26-30 years
g. >30 years

7. Is your healthcare license to administer, dispense, or prescribe active and without restrictions?

a. Yes
b. No

8. Did you attend the first session on opioid induced hyperalgesia?

a. Yes
b. No

9. Select the definition of opioid induced hyperalgesia. (Please do not use Google)
   a. An elevated pain response to an injury or chronic condition
   b. A diagnosis used by chronic pain patients to receive an increase in dosage or type of opioid
   c. An elevated pain response secondary to opioid tolerance
   d. A response to pain caused by an elevated or chronic opioid use

10. Rank the top 5 opioids you administer, prescribe, or dispense in your practice with 1 signifying the most frequent and 5 the least frequent.
   a. Morphine controlled release
   b. Hydrocodone with acetaminophen
   c. Oxycodone with or without acetaminophen
   d. Morphine immediate release
   e. Morphine IV
   f. Methadone
   g. Nucynta
   h. Hydromorphone
   i. Tylenol #3
   j. Fentanyl IV
   k. Fentanyl patches
   l. Fiorcet
   m. Tramadol
   n. I do not prescribe or administer opioids

11. Select the frequency percentage of dispensing, prescribing, or administering of opioids in your practice in the last 6 months.
   a. 0-20%
   b. 21-40%
   c. 41-50%
   d. 51-60%
   e. 61-70%
   f. 71-80%
   g. >81%
   h. I do not prescribe, dispense, or administer opioids

12. Rank the top 6 conditions you most frequently administer, prescribe, dispense (if known) opioids for.
   a. Fractures
   b. Abdominal pain not related to surgical procedure
   c. Minor surgery (port-a-cath insertion/removal, pacemaker, etc)
   d. Abdominal surgery (laparoscopic, robotic assisted)
   e. Open abdominal surgery

f. Joint arthroplasty (total and partial)
g. Arthroscopic joint
h. Mastectomy
i. Amputation of limb
j. Partial amputation
k. Kidney stones
l. Back pain
m. Migraines
n. Muscle strains
o. Joint sprains
p. Dental procedure
q. Tonsillectomy and adenectomy
r. Thyroidectomy or parathyroidectomy
s. I do not prescribe/administer/dispense opioids

13. What would you estimate as the frequency of opioid induced hyperalgesia patients you have seen in your practice?

a. 0-20%
b. 21-40%
c. 41-60%
d. 61-75%
e. 76-90%
f. >90%

14. Do you believe opioid induced hyperalgesia is separate from tolerance?

a. Yes
b. No

Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

15. Alternative analgesics					
Alternative analgesics work in relieving pain, including chronic pain.	1	2	3	4	5
I recommend/administer/dispense alternative analgesics.	1	2	3	4	5
I prefer to use alternative analgesics prior to opioids.	1	2	3	4	5

Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

16. Provider conversations with patients, weaning, and tapering opioids					
I am comfortable having conversations with patients and weaning of chronic opioids	1	2	3	4	5
I am comfortable having a conversation with patients about realistic pain expectations.	1	2	3	4	5
I am comfortable with tapering patients off chronic opioids with current education.	1	2	3	4	5

17. Rank the top 5 alternative analgesics that you prescribe/administer/recommend to your patients with 1 signifying the most recommended/prescribed/administered.

a. Aspercream gel or patches
b. Tylenol or acetaminophen
c. Motrin or Advil or ibuprofen
d. Al-eve or naproxen sodium
e. Cymbalta or duloxetine
f. Neurontin or gabapentin
g. Icy Hot
h. Lidocaine (non-prescription strength)
i. Ice pack
j. Heating pad
k. Bio freeze
l. Diclofenac
m. Epidural injections
n. Physical or occupational therapy
o. Massage therapy
p. Acupuncture
q. Aromatherapy
r. Hypnosis

Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree, 6 = does not apply

18. Provider comfort and knowledge of peripheral nerve blocks						
I am proficient in performing a peripheral nerve block.	1	2	3	4	5	6
Peripheral nerve blocks significantly decrease opioid use.	1	2	3	4	5	6
I encourage my patients to receive nerve blocks if offered for surgery.	1	2	3	4	5	6

Appendix E

Poll Questions for Provider Education Second Grand Rounds

1. What is the definition of OIH?

   a) An elevated pain response to an injury or chronic condition
   b) A diagnosis used by chronic pain patients to receive an increase in dosage or type of opioid
   c) An elevated pain response secondary to opioid tolerance
   d) A hyper response to pain sensation caused by elevated or chronic opioid use

2. What do you estimate would be the percentage of patients that believe opioids are the first medications used to treat pain?

   a) 0-5%
   b) 6-20%
   c) 21-60%
   d) More than 60%

3. How likely do you believe that prescription alternative analgesics are likely to work on pain better instead of opioids?

   a) 1-15%
   b) 16-25%
   c) 26-50%
   d) 51-75%
   e) >76%
   f) Never

4. What percentage do you use the PDMP in your practice or have accessed a provider's PDMP at their request prior to prescribing any controlled substance?

   a) 1-15%
   b) 16-25%
   c) 26-50%
   d) 51-75%
   e) 76-90%
   f) >90%
   g) Never

5. What class of antidepressants are you most likely to see for someone with chronic pain as an alternative analgesic?

a) SSRI
b) SNRI
c) TCA/TeCA
d) NDRI
e) MAOI

6. What NDMA antagonist would you recommend on a normal basis?

a) Ketamine
b) Magnesium
c) Exelon
d) Namenda
e) Spravato
f) None of the above

7. What do you think is the best benefit of using a topical NSAID for pain?

a) Direct application to area of pain for fast relief
b) Bypasses the systemic absorption decreasing the renal/GI effects
c) Massaging the area of pain
d) More of a placebo effect for the patient

Appendix F

Opioid Induced Hyperalgesia Provider Post-Education Part 2

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia (OIH). This survey will assist in evaluating the education healthcare providers received. This survey should take about 5-10 minutes to complete and your answers will be confidential. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP Scholarly Project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Rank the top 5 opioids that you will likely prescribe or administer after the education provided, with 1 signifying the most likely to prescribe or administer.

a. Oxycodone with/without acetaminophen
b. Morphine controlled release
c. Methadone
d. Hydromorphone
e. Fiorcet
f. Tramadol
g. Hydrocodone with acetaminophen
h. Morphine immediate release
i. Morphine IV
j. Nucynta
k. Tylenol #3
l. Fentanyl IV
m. Fentanyl patches
n. Do not prescribe or administer opioids

2. Select the frequency percentage you intend to dispense, prescribe, or administer of opioids in your practice after receiving the education.

a. 0-20%
b. 21-40%
c. 51-60%
d. 61-70%
e. 71-80%
f. > 80%

3. Rank the top 5 alternative analgesics that you will prescribe, administer, or recommend to your patients with 1 signifying the most recommended, prescribed, or administered.

a. Ice pack
b. Heating pad
c. Tylenol or acetaminophen
d. Diclofenac
e. Motrin, Advil, or ibuprofen
f. Al-eve or naproxen sodium
g. Corticosteroids (oral or one time IM shot)
h. Cymbalta or duloxetine
i. Neurontin or gabapentin
j. Icy hot or Aspercream gel or patches or Bio Freeze
k. Epidural injections
l. Physical or occupational therapy
m. Massage therapy
n. Acupuncture or aromatherapy or meditation
o. Hypnosis
p. Peripheral nerve blocks (if applicable for your profession)

4. Estimate how many OIH patients you have seen in your practice since you have received education.

a. 0-10
b. 11-20
c. 21-30
d. 31-40
e. 41-50
f. 51-60
g. 61-75
h. 56-90
i. > 90

5. Rank the top 6 conditions you intend to most frequently administer, prescribe or dispense opioids for.

a. Fractures
b. Open abdominal surgery
c. Arthroscopic joint surgery with/without repairs
d. Muscle strains
e. Dental procedure/pain
f. Abdominal pain not related to a surgical procedure

g. Minor surgery (port-a-cath insertion/removal, pacemaker, etc.)
h. Abdominal surgery (laparoscopic, robot assisted)
i. Joint arthroplasty (total, partial, or revision)
j. Mastectomy
k. Amputation of limb (total or partial)
l. Kidney stones
m. Back pain
n. Migraines
o. Joint sprains
p. Tonsillectomy and Adenectomy
q. Thyroidectomy or parathyroidectomy (total or partial)

6. Please indicate your level of agreement with the following statements using the following scale: 1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

Provider beliefs about alternative analgesics					
Alternative analgesics work in relieving pain, including chronic pain.	1	2	3	4	5
I recommend, administer, or dispense alternative analgesics.	1	2	3	4	5
I prefer to use alternative analgesics prior to opioids.	1	2	3	4	5

7. Please indicate your level of agreement with the following statements using the following scale: 1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

Provider beliefs about opioids, pain conversations, and finding help for patients					
I am comfortable having realistic pain expectation conversations with my patients after being educated on OIH.	1	2	3	4	5
I feel that I know how to find resources to help my patients taper their chronic opioid use.	1	2	3	4	5
I know of resources in my patients' communities for opioid addiction and treatment.	1	2	3	4	5
I know how to find resources available in my patients' communities for opioid addiction and treatment.	1	2	3	4	5

8. Do you intend to decrease your average prescribing or dispensing rate for patients in the next 3 months?

a. Yes

b. No

9. By how much do you intend to increase your administering, prescribing, or recommending of alternative analgesics in the next 3 months?

a. 0-10%
b. 11-20%
c. 21-30%
d. 31-40%
e. 41-50%
f. 51-60%
g. 61-75%
h. 75-85%
i. > 86%

10. Please indicate your level of agreement with the following statements using the following scale: 1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree, 6=does not apply

Provider beliefs about nerve blocks						
Peripheral nerve blocks significantly decrease opioid use.	1	2	3	4	5	6
I encourage my patients to ask about nerve blocks for surgery.	1	2	3	4	5	6
I encourage my patients to receive nerve blocks for surgery if option is available.	1	2	3	4	5	6
I intend to become more proficient in nerve blocks that I will administer to patients.	1	2	3	4	5	6

11. If you would like to be contact in 3 months, please provide an email address that a line for another survey may be sent to for evaluation of practice changes post education of providers and the public. If you elect to be contacted for follow up and complete the follow up survey your email will be entered into a drawing for a $25 Amazon gift card. Thank you again for your participation.

Appendix G

Opioid Induced Hyperalgesia Public Pre-Education

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia. This survey will assist in evaluating the education needs for the general public. This survey should take about 10 minutes to complete and your answers will be confidential. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP Scholarly Project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Age:
   g. 18-29 years
   h. 30-39 years
   i. 40-49 years
   j. 50-59 years
   k. 60-69 years
   l. 70 years and above

2. What gender do you identify yourself as?
   d. Male
   e. Female
   f. Prefer not to answer

3. What is your highest level of education?
   l. Did not graduate high school
   m. Graduated high school or GED
   n. Some college but no degree
   o. Vo-tech training
   p. Associate degree
   q. Bachelor's degree
   r. Master's degree
   s. PhD
   t. Practice doctorate
   u. None of the above
   v. I prefer not to answer

4. Please select the definition of opioid induced hyperalgesia. (Please do not use Google)

a. An elevated pain response to an injury or chronic condition
b. An elevated pain response because of opioid tolerance
c. A response to pain sensation caused by an elevated or chronic opioid use
d. A condition where opioids do not work on pain so there is no pain relief

5. Rank the top 4 reasons you believe opioids should be prescribed, excluding surgeries, with 1 signifying the top reason.

a. Broken bones
b. Upper back pain
c. Middle back pain
d. Lower back pain
e. Sprained joint
f. Abdominal pain
g. Joint pain not due to injury, including arthritis
h. Headache, including migraines
i. Muscle aches
j. Other (please specify)

6. Select the top 4 non-prescription medications you believe are best for pain relief with 1 signifying the top reason.

a. ____ Tylenol or acetaminophen
b. ____ Motrin or ibuprofen or Advil
c. ____ Aleve or naproxen sodium
d. ____ Icy Hot
e. ____ Lidocaine (non-prescription strength)
f. ____ Aspercream gel or patches
g. ____ Ice pack
h. ____ Heating pad
i. ____ Bio freeze
j. ____ Diclofenac

7. How frequently have you seen a healthcare provider to obtain a prescription for opioids in the last 6 months? Calls for chronic or short term opioid refills and initial calls for new opioid requests are included. Select all that apply

a. 0-5 times
b. 6-10 times
c. 11-20 times
d. 21-30 times
e. 31-40 times

f. > 40 times
g. 1-5 calls to the office
h. 6-10 calls to the office
i. 21-30 calls to the office
j. More than 30 calls to the office
k. I have not asked or called for an opioid prescription in the last 6 months

8. Select the frequency that you take opioids per week. This includes ALL opioids taken as individual times.

a. 1-10 times
b. 11-15 times
c. 16-20 times
d. 21-25 times
e. 25-30 times
f. > 30 times
g. I do not take opioids

Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

9. Public participant beliefs regarding opioids					
Opioids are the first drugs to be used in the treatment of pain	1	2	3	4	5
I am comfortable having a realistic pain conversation with my healthcare provider	1	2	3	4	5
I know how to find help for opioid related problems other than using Google	1	2	3	4	5

10. How many pills do you take per opioid dose? If you take liquid opioids, consider the lowest amount you are supposed to take as a pill.

a. 1-2
b. 3
c. 4
d. 5
e. I do not take opioids

Appendix H

Poll Questions for the Public Education

1. Without using Google, what is the definition of opioid induced hyperalgesia?

    e. An elevated pain response to an injury or chronic condition
    f. An elevated pain response because of opioid tolerance
    g. A response to pain sensation caused by an elevated or chronic opioid use
    h. A condition where opioids do not work on pain so there is no pain relief

2. What do you think is the strongest oral opioid?

    a. Oxycodone
    b. Morphine
    c. Hydrocodone
    d. Tramadol
    e. Dilaudid

3. What do you think is the most likely cause of opioid induced hyperalgesia?

    a. Long term opioid use
    b. Single time high dose opioid
    c. Intermittent use of opioids
    d. All of the above
    e. None of the above

4. What are you able to do easily at a pain rating greater than 8?

    a. Breathe
    b. Talk/text/message
    c. Social media
    d. Watch television
    e. sleep

5. At what pain level should you take an opioid?

    a. Mild
    b. Moderate
    c. Severe
    d. “I’m going to die”
    e. Never

6. What are common medications that you could take, that are not opioids, to help relieve your pain?

    a. Tylenol or acetaminophen
    b. Motrin or ibuprofen

c. CBD
d. Aleve

7. How should you decrease your opioid intake?

a. All at once
b. Never
c. "go big or go home" changes
d. Slowly at the advisement of your provider

Appendix I

Opioid Induced Hyperalgesia Provider Practice Application of Education

Thank you for taking the time to participate in this survey about opioid induced hyperalgesia (OIH). This survey will assist in evaluating the application into practice the education healthcare providers received and the overall impact the public education was regarding OIH. This survey should take about 5-10 minutes to complete and your answers will be confidential. Your email address will be placed into a drawing for a $25 Amazon gift card after completion of the survey. This survey is conducted by Jenny Greene, RN-BSN, current DNP student at Pittsburg State University, Pittsburg, KS, as part of her DNP scholarly project. Jenny can be reached by email, jgreene@gus.pittstate.edu. Thank you for your time.

1. Rank the top 5 opioids that you prescribed/administered/dispensed in the last 6 months with 1 signifying the most frequently prescribed/administered/dispensed.

a. _____ hydrocodone with acetaminophen
b. _____ oxycodone
c. _____ oxycodone with acetaminophen
d. _____ morphine-controlled release
e. _____ morphine immediate release
f. _____ morphine IV
g. _____ methadone
h. _____ Nucynta
i. _____ hydromorphone
j. _____ Tylenol #3
k. _____ fentanyl IV
l. _____ fentanyl patches
m. _____ fiorcet
n. _____ tramadol

2. Select the frequency percentage have administered/prescribed/dispensed opioids in the last 3 months.

g. 0-20%
h. 21-40%
i. 41-50%
j. 51-60%
k. 61-70%

l. 71-75%
m. 76-80%
n. 81-90%
o. >90%

3. Rank the top 5 alternative analgesics that you prescribe/administer/recommend to your patients with 1 signifying the most recommended/prescribed/administered.

a. ____ Tylenol or acetaminophen
b. ____ Motrin or ibuprofen or Advil
c. ____ Aleve or naproxen sodium
d. ____ Cymbalta or duloxetine
e. ____ Neurontin or gabapentin
f. ____ Icy Hot
g. ____ Lidocaine (non-prescription strength)
h. ____ Aspercream gel or patches
i. ____ Ice pack
j. ____ Heating pad
k. ____ Bio freeze
l. ____ Diclofenac
m. ____ Epidural injections
n. ____ Physical or Occupational therapy
o. ____ Massage therapy
p. ____ Acupuncture
q. ____ Aromatherapy
r. ____ Hypnosis
s. ____ Meditation

4. Please select your estimation of OIH patients in your practice.

a. 0-20%
b. 21-40%
c. 41-60
d. 61-75%
e. 76-90%
f. >90%

Please rate your agreement with the following statement using the following scale:

1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

5. Opioid induced hyperalgesia causes and diagnosis

Healthcare providers are one of the main causes of the opioid crisis and/or high numbers of people with opioid addiction	1	2	3	4	5
Opioid induced hyperalgesia is a real diagnosis	1	2	3	4	5
Opioid induced hyperalgesia is separate from drug seeking behavior	1	2	3	4	5
My current level of knowledge regarding OIH is sufficient	1	2	3	4	5
I need more education targeted to tapering chronic opioid medications	1	2	3	4	5

6. Do you believe opioid induced hyperalgesia is separate from tolerance?

   c. Yes
   d. No

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

7. Alternative analgesics					
Alternative analgesics work in relieving pain, including chronic pain	1	2	3	4	5
I recommend/administer/dispense alternative analgesics	1	2	3	4	5

Please indicate your level of agreement with the following statements using the following scale:

1= strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

8. Conversations with patients and weaning of opioids					
I am comfortable having realistic pain expectation conversations with my patients after being educated on OIH	1	2	3	4	5
I feel that I know how to find resources to help my patients taper their chronic opioid use	1	2	3	4	5

9. By how much has your average MME prescribing rate for patients decreased?

   a. ____ 0-5%
   b. ____ 6-10%

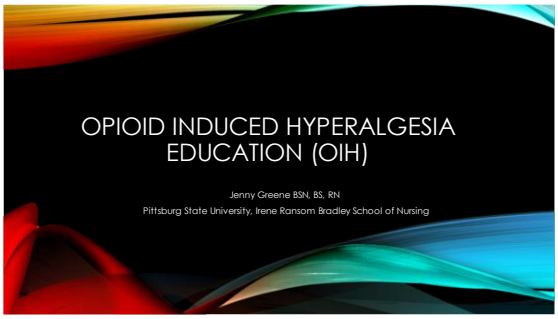
c. ____ 11-15%
d. ____ 16-20%
e. ____ 21-30%
f. ____ 31-40%
g. ____ 41-50%
h. ____ 51-75%
i. ____ >75%
j. ____ I have not made any changes
k. ____ I do not prescribe medications

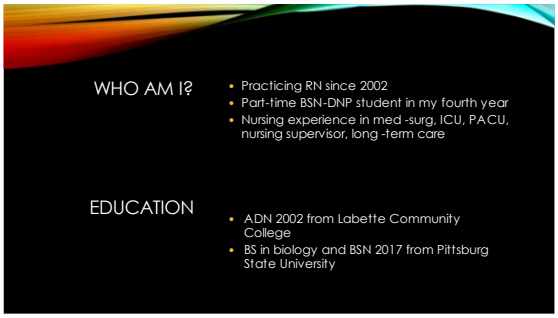
10. By how much percentage have you increased prescribing or recommending alternative analgesics?

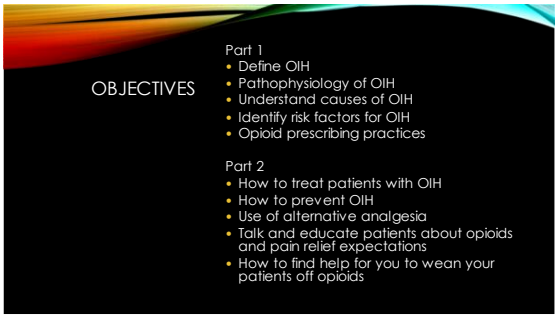
a. I don't prescribe or recommend them
b. 1-10%
c. 11-20%
d. 21-30%
e. 31-40%
f. 41-50%
g. 51-60%
h. 61-70%
i. 71-80%
j. > 80%

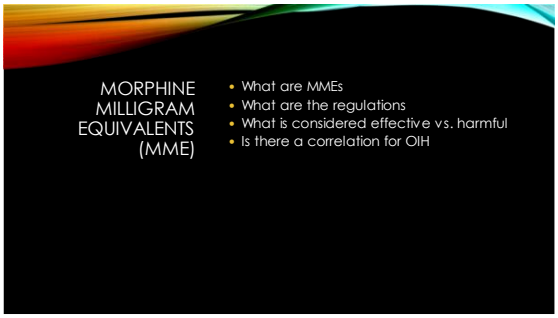
Appendix J

Grand Rounds 1 PowerPoint









DRUG NAME	ORAL ROUT	PARENTERAL ROUT	CONVERSION RATIO TO ORAL MORPHINE	EQUIANALGESIC DOSE OF ORAL MORPHINE
Morphine Sulfate	30mg Oral Morphine	10mg Parenteral Morphine	Parenteral Morphine is **3 times** as potent as Oral Morphine	30mg Oral Morphine
Oxycodone	30mg Oral Oxycodone	N/A	Oral Oxycodone is **1.5 times** more potent than Oral Morphine	30mg Oral Morphine
Hydrocodone	30mg Oral Hydrocodone	N/A	**Oral Hydrocodone is has the same potency as Oral Morphine**	30mg Oral Morphine
Hydromorphone (Dilaudid)	7.5mg Oral Hydromorphone	1.5mg Parenteral Hydromorphone	Oral Hydromorphone is **4-7 times** more potent than Oral Morphine Parenteral Hydromorphone is **20 times** more potent than Oral Morphine	30mg Oral Morphine
Fentanyl	Transdermal: 15mcg/hr	100mcg Parenteral Fentanyl	**Transdermal Fentanyl is 80 times more potent than Oral Morphine** **Parenteral Fentanyl is 300 times more potent than Oral Morphine**	30mg Oral Morphine
Meperidine (Demerol)	300mg Oral Meperidine	75mg Parenteral Meperidine	**Oral Morphine is 10 times more potent** than Oral Meperidine and twice as potent as Parenteral Meperidine	30mg Oral Morphine
Tramadol	300mg Oral Tramadol	N/A	**Oral Morphine is 10 times more potent than Oral Tramadol**	30mg Oral Morphine
Codeine (Tylenol #3)	200mg Oral Codeine	N/A	Oral Morphine is 6.5 times more potent than Oral Codeine	30mg Oral Morphine

PATHOPHYSIOLOGY

- Medications known to cause
  - Koo et al. (2017)
- Doses of opioids associated with OIH predisposition
  - Mauermann et al. (2016)
  - Yildirim et al. (2014)

OIH DIAGNOSIS

- Clinical presentation
  - During maintenance
  - During withdrawal
- Use of quantitative sensory testing (QST)
  - Types
  - Routine use in the future?
- Tolerance/dependence

PATHOPHYSIOLOGY

- Mechanisms behind OIH
  - Mao (2009)
  - Koo et al. (2017)
  - Linnstaedt et al. (2015)

Clinical factor	OIH	Opioid tolerance
Exacerbated temporal summation of second pain (QST)	Yes	No
Decreased pain threshold (QST)	Yes	No
Decreased pain tolerance (QST)	Yes	No
Relationship with opioid dose (the higher, the more likely to be present)	Yes	Yes
Relationship with duration of opioid treatment (the longer, the more likely to be present)	Yes	Yes
Opioid dose escalation	Limited improvement in clinical pain scale and QST responses	Improved pain relief
Opioid dose reduction	Improved opioid analgesia	Reduced opioid analgesia
Pain quality	Burning, diffuse pain, and spontaneous pain similar to those seen with neuropathic pain	No change
Pain location	At and/or beyond the dermatome distribution of a preexisting pain condition	No change
Pain intensity	Similar or greater than the preexisted pain condition	Similar to the preexisted pain condition
Influence by opioid type	Unclear	Unclear
Influence by gender	Unclear	Unclear

Abbreviations: OIH, opioid-induced hyperalgesia; QST, quantitative sensory testing.

Mao (2009)

PATHOPHYSIOLOGY

- Receptors implicated
- Koo et al. (2017)
- Adams, Holland, and Urban (2017)
- Wang et al. (2016)

PATHOPHYSIOLOGY

- Commonalities between patients
  - Linnstaedt et al. (2015)

PATHOPHYSIOLOGY

- Genetic predisposition
  - Males vs females– who is more likely to develop it
  - Linnstaedt et al. (2015)
  - Arout, Caldwell, Rossi, and Kest (2015)

PATHOPHYSIOLOGY

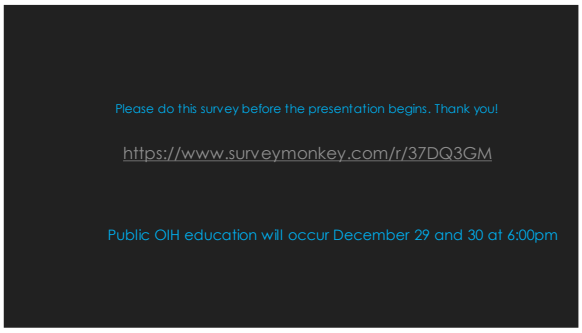
- Chronic opioid use
  - Hina, Fletcher, Poindessous-Jazat, and Martinez (2015)
  - Wasserman et al. (2014)
  - Wasserman et al. (2015)
  - Pivec et al. (2014)

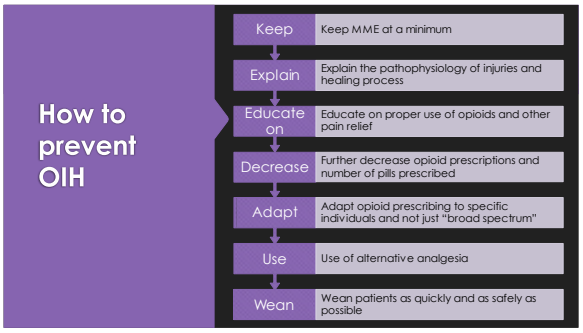
OPIOID PRESCRIBING PRACTICES

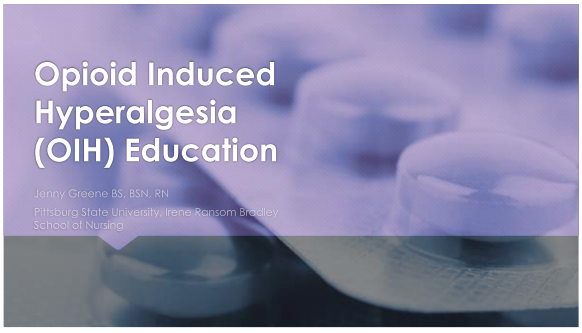
- U.S. rates compared to foreign countries
  - Onishi et al. (2017)
- Education for opioid prescribing
  - Holiday et al. (2017)

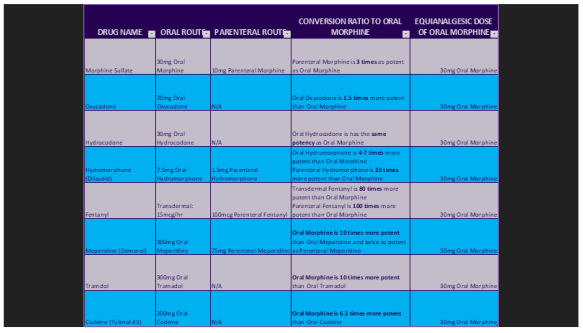
Appendix K

Grand Rounds 2 PowerPoint



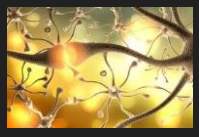






Alternative analgesics: Antidepressants

- SNRI
  - Duloxetine
  - Venlafaxine
- SSRI?
- TCA



Alternative analgesics: Skeletal muscle relaxants

- Flexeril
- Baclofen
- Soma
- Botulinum toxin

Alternative Analgesics: Anticonvulsants

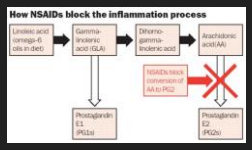
- Gabapentin
- Topiramate
- Pregabalin

Alternative analgesics: Steroids

- Medrol dose pack
- Prednisone
- Dexamethasone
- Depo-Medrol
- Joint injections

Alternative analgesics: NSAIDs

- Toradol
- Ibuprofen
- Al-eve
- Capsaicin
- Diclfonac
- Pennsaid
- Ofirmev
- Tylenol
- Tylenol ES
- Tylenol arthritis



Alternative Analgesics: NMDA antagonists

- Ketamine
- Magnesium

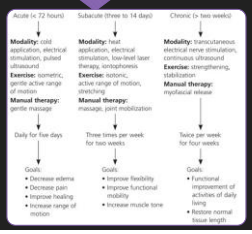
Alternative analgesics: OTC topicals

- Bio freeze
- Diclofenac gel 1%
- Lidocaine gel and patches
- CBD sticks or lotion
- Asper cream or Bengay

Pain control conversations with patients

- Per Facebook survey, 44.94% of patients responded they were comfortable with having a realistic pain expectation conversation with their provider; providers 66% comfortable
- Surgical pain prior to no pain– patients do not always understand there is pain first
- Do patients understand the pathophysiology of the cause of their pain?
- Are they given opioids as a first line treatment based on history or condition?

Alternative analgesics



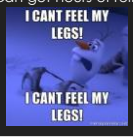
- PT/OT
  - Iontophoresis
- Massage
- Acupuncture
- Meditation
- Yoga
- Weight loss
- TENS unit
- CBD oil and/or capsules

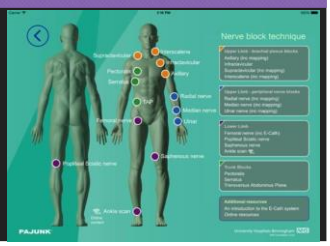
Pain relief expectations

- Can your patient recite back what the realistic pain level is
- Do they understand pain will not kill them
- Speed of recovery process

Peripheral nerve blocks

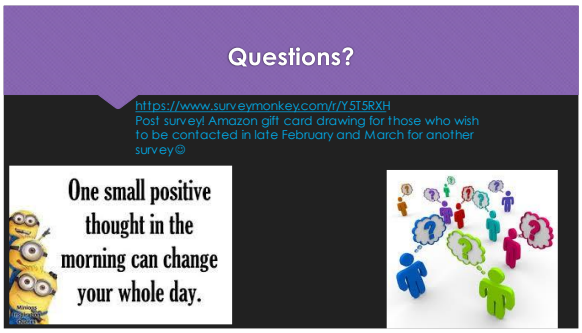
- Use with a local anesthetic
- Placed with ultrasound
- Have been useful with decreasing opioid use
- Can get hours of relief





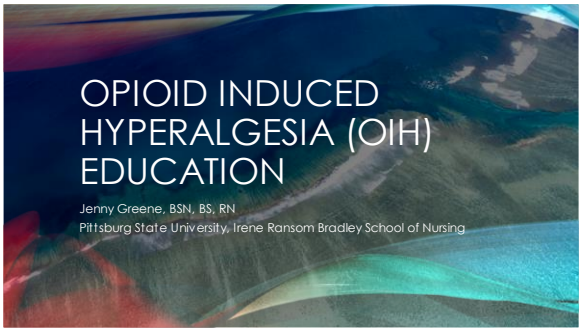
Opioid weaning resources

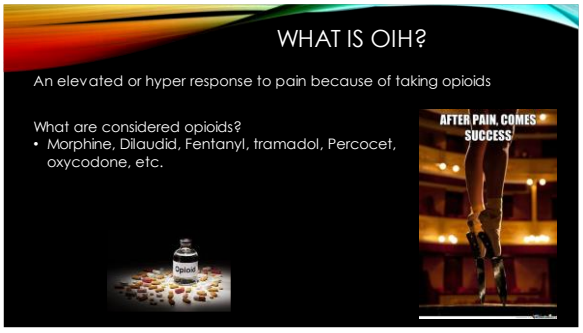
- https://www.helpguide.org/harvard/opioid-addiction.htm -- Harvard opioid addiction site
- https://kdads.ks.gov/commissions/behavioral-health/services-and-programs/substance-use-disorder-treatment-services
- https://www.samhsa.gov/find-help/national-helpline
- Know where your methadone clinics are and how to get a patient referred
- Educate on importance of not abruptly stopping opioids

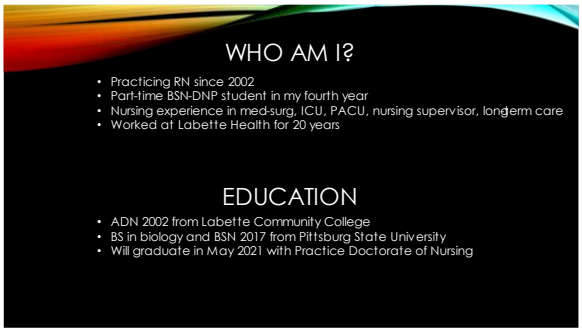

Questions?
https://www.surveymonkey.com/r/Y5T5RXH
Post survey! Amazon gift card drawing for those who wish to be contacted in late February and March for another survey☺
One small positive thought in the morning can change your whole day.

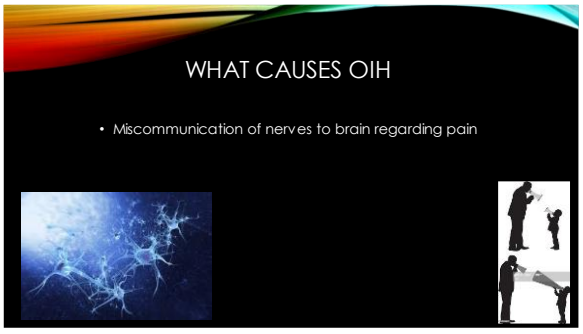
Appendix L

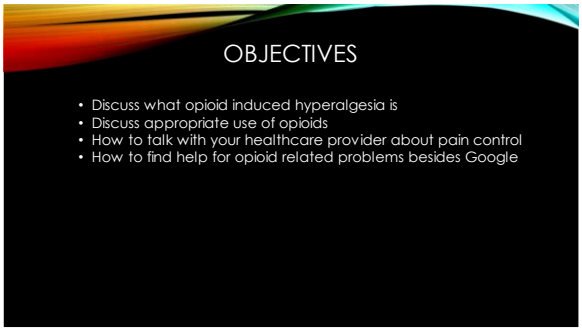
Public Educational Session PowerPoint











HOW IS OIH TREATED?

- Weaning opioids
- Alternative analgesia
- Physical or occupational therapy
- Adaptive equipment for normal life

COMMON AILMENTS THAT DO NOT REQUIRE OPIOIDS

- Back pain – therapy, movement, muscle relaxers, heat/ice, over the counter pain relief patches, short course of steroids
- Migraines/headaches – opioids do not treat the mechanism behind the pain, only force the body to "reset" and correct itself; can become a bigger problem and cause more migraines/headaches if overused
- Broken bones – not all breaks are equal and not all require opioids
- Kidney stones – ibuprofen and other NSAIDs work just as well as opioids
- Muscle strains – opioids do not treat the cause of the pain or reverse the injury
- Sprains – opioids do not treat the cause of the pain or reverse the injury

PAIN SCALE

- 0-1 able to do anything with just a small amount of discomfort
- 2-3 am a little uncomfortable but can still function with little interference
- 4-5 starting to feel more uncomfortable and am having to make some mild adjustments to activity
- 6-7 more uncomfortable and making a few more adjustments to activity and movement but am still able to text or use phone, watch television, and browse social media
- 8-9 pretty uncomfortable regardless of adjustments made during activity; activity has significantly decreased; am struggling to continue with normal life including use of cell phone, watching television, and interaction on social media
- 10 unable to: move, talk on cell phone, watch television, text anyone, or browse any social media site/app

ALTERNATIVE PAIN RELIEVERS

- Antidepressants
- Acetaminophen
- Ibuprofen
- Seizure medications
- Alternative medicine – acupuncture, massage therapy, etc.
- Heat/cold
- OTC gels/patches
- CBD
- Corticosteroids on a short-term basis

PAIN SCALE INTERVENTIONS

- 0-1 likely do not need to do anything at this point
- 2-3 try an ice pack or heating pad, even some topical ointments should work
- 4-5 try Tylenol or ibuprofen; Al-eve is a good option as well
- 5-6 have you tried ice/heat, topical ointments, or taken some Tylenol, Al-eve or ibuprofen? Reposition yourself or the specific area of pain, try having a massage to the area
- 7-8 take the least amount of the strongest medication you have prescribed for you; if nothing has worked, then should see your doctor or express care
- 9-10 if nothing has worked and you are UNABLE to function then seek medical help

OPIOID RELATED PROBLEMS AND HOW TO GET HELP

- Depression
- Weaning of opioids – discuss with your provider how to wean yourself off opioids; if long-term, don't just stop without decreasing the doses
- Opioid addiction
  - SAMHSA – 1-800-662-4357
  - 1-877-882-9275 will help find a drug rehab center near you
  - KDADS - https://kdads.ks.gov/commissions/behavioral-health/services-and-programs/substance-use-disorder-treatment-services

help me...

OPIOID WEANING SUGGESTIONS

- Write goals down
- Set "quit" date
- Keep a written diary of amount, when, and type of opioid taken
- Keep opioids out of the house
- Have "drug free days"
- Keep busy – start a hobby, exercise, etc.
- DO NOT BE AFRAID TO ASK OTHERS FOR HELP
- DO NOT DRASTICALLY REDUCE OR STOP OPIOIDS

HOW CAN I PREVENT OIH?

- Appropriate use of opioids
- Use alternative analgesia methods
- Openly talk with and listen to your healthcare provider about realistic pain expectations
- Be honest about your pain and its limitations
- Remember that it is normal to have some painas long as you can continue to perform your normal activities with/without adaptions
- Learn how to adapt your life around physical limitations
- Keep moving but don't overdo the activity

QUESTIONS?