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## Post-laminectomy Back Pain: Understanding the Progress from Acute to Chronic Pain State

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Final DNP Project Report

Post-laminectomy Back Pain:  
Understanding the Progress from Acute to Chronic Pain State

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University of Kentucky

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## Dedication

This work is dedicated to my father Dallas Calhoun who taught me that a man can be wealthy and have all that he ever wanted only to lose everything without warning. But an education is something that no one can ever take away and will never be lost.

## Acknowledgements

I would like to acknowledge my committee members Drs. Howard and Hampton for all of their positive feedback and encouragement. I would also like to acknowledge my clinical mentor Dr. Grider for his guidance and instruction over the last ten years.

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## Capstone Report Introduction

James Derek Calhoun

University of Kentucky

In the United States, 74.6% of patients who have undergone lumbar laminectomy surgery will have residual lower back pain and as much as 43% of them will develop chronic pain (DePalma, Ketchum & Saullo, 2011; Hussain & Erdek, 2014). Some of those who have experienced lumbar laminectomy will eventually seek help from providers of chronic pain clinics where various methods of pain control may be used. However, the majority of patients will not receive a referral to a chronic pain facility, but instead will rely on follow up treatment for pain from the surgeon or from their primary care providers (Calhoun, Manuscript III, 2014). Ineffective control of chronic pain is not limited to those with post-laminectomy back pain, but may occur for various other conditions. Nonetheless, this research is targeted to orthopedic surgeries, with an emphasis on lumbar laminectomy surgeries because of the large number of patients who have undergone these procedures and are seen at pain clinics.

The first manuscript presented in this paper is a literature review focused on measures taken after various types of orthopedic surgery to prevent or lessen chronic pain. Results of this review revealed that there is a lack of effective pain control follow-up post-operatively and intervention to prevent the onset of chronic pain is needed (Calhoun, 2014). Pasero and McCaffrey (2007) stated that early intervention from a multidisciplinary team comprised providers with knowledge and experience about pain management, working together, improves



outcomes for patients with chronic pain. Recommendations for practice are included in the literature review paper.

The second manuscript addresses the gaps in management of chronic pain for post-operative patients focusing on opioid use and associated risks with opioid use. Monitoring the use of opioids is important in that as many as 10% of patients who are treated with opioid medications will develop addiction problems (Garland, et al., 2013). Manchikanti, et al. (2011) suggest that opioids, while effective in treating pain in the short-term, are not effective in promoting return to full functional capacity. In addition, Adamson, et al. (2011) suggests that opioids are not effectively monitored once a patient has been discharged after surgery.

Transitional intervention plans of various types are also reviewed in manuscript II. Naylor, et al. (2004) found that advanced practice nurses play an integral part in successful implementation of transitional care for patients including a reduction in hospital readmissions when monitored post-discharge by an advanced practice nurse. Literature findings also indicated there are no formal transitional plans for chronic pain management. Therefore, suggestions that could improve the pain levels of these patients are included in the paper.

Because of gaps in the literature, the final manuscript focuses on creating a transitional element, led by advanced practice nurses, to manage the problems between acute and chronic pain development and improve outcomes for patients. The paper is based on a study about patients who had undergone lumbar laminectomy surgery. The purpose of the study was to determine if treatment in a chronic pain clinic could result in a reduction in the development of a chronic pain state for adult patients who have had lumbar laminectomy surgery. Aims of the study were to better understand factors that lead to the development of chronic pain, to discover what is being done about managing the transitional state from acute post-operative pain to

development of a chronic pain state, and to learn about interventions and approaches to treatment that can assist providers in improved management of post-operative pain.

Subjects (n=50) were interviewed about their experiences with post-surgical and chronic pain. The self-report questionnaire included items to determine whether subjects were offered any pain treatment, where the treatment occurred, whether there was a referral to a pain treatment center, and types of pain treatments and post-surgical interventions used. Demographic data collected from the medical record included smoking status and history of anxiety and/or depression. Study findings and recommendations are included in the results and conclusions sections of the paper.

## Manuscript I

### ABSTRACT

The occurrence of postoperative pain from lower back surgery is almost a certainty. Pain following back surgery has been treated with opioids for many years. This type of pain can be debilitating and may lead to a chronic pain state resulting in extensive treatment. Existing literature was reviewed to identify current avenues of treatment as well as to understand more about the prevalence of pain among those who have had orthopedic surgeries, specifically, laminectomy of the lumbar vertebra. An aim of this paper is to report information from the literature about chronic pain development in order to contribute to a study designed to determine whether an intermediate, post-discharge intervention following surgery, would be effective. The literature review revealed a dearth of information concerning laminectomies. The types of pain identified in existing studies are common complaints identified in the chronic pain treatment setting. The varied treatments for these types of pain are addressed in the review to increase understanding about chronic pain development. Patients with lumbar postoperative conditions are reported to have a high level of pain. Lumbar postoperative pain can develop into a chronic pain state, regardless of the type of treatment and follow up.

Key Words: Chronic, Pain, Postoperative, Lumbar Laminectomy, Surgery

## **Advanced Nursing Practice: Evidence Based Need on Closing the Gap between Post-surgical Pain Treatment and the Onset of Chronic Pain**

Patients admitted to an acute care hospital with back pain may require surgery or treatment that can be difficult to manage. Back pain can be agonizing and enduring. Often, low back pain is treated with opioid medications that have severe and dangerous side effects. Therefore, medication use must be monitored closely. When a patient has been treated and is ready for discharge from the hospital, it is common practice to give a prescription for pain medications for a short period of time. Unfortunately, the pain can persist for a longer period of time than that covered by a prescription. If this happens, the patient is forced to rely on primary care or emergency department providers to offer a remedy for the pain. If opioid medications are effective in treating the pain, the patient may seek to continue these medications, thus increasing the importance of close monitoring. However, providers may be unaware about how others are treating the patient and this problem is exacerbated if the patient does not understand his or her condition or the importance of opioid safety.

After a period of several months, pain can become chronic in nature. A patient's primary care provider may not wish to treat a chronic condition with opioids. Repeated trips to the emergency department may even create stigma for the patient about "being a drug seeker". An alternative approach is treatment is a chronic pain clinic. Unfortunately, by the time many patients are seen at these clinics, they have developed tolerance to the medications, addiction issues or mental, emotional and physical decline from dealing with their pain on a daily basis.

## **Current Status of the Problem**

DePalma, Ketchum and Saullo (2011) suggest that approximately 13-43% of patients who have undergone surgery for lumbar laminectomy will develop chronic pain. Their findings are supported by others (Castillo, et al., 2006; Nikolajsen, et al., 2006; Martinez, et al., 2007; Rivera, et al., 2008; Williamson, et al., 2009; Morrison, et al., 2009; Chiono, et al., 2010; & Buvanendran, et al., 2010). The importance of these studies has implications for how pain is treated. A major concern about the study of pain is that morbidity, co-morbidity and mortality rates vary greatly depending on the type of trauma and surgical intervention for those affected.

Dallas (2012) estimates that the cost of chronic pain in the United States, in general, is approximately \$635 billion annually. Furthermore, Dallas stated that orthopedic related conditions resulted in higher costs, ranging from \$4,048 to \$5,838 per patient for a single incident. Dallas also suggested that many orthopedic conditions may account for up to 58% of all chronic pain costs. Yet health care costs are not the only concern since workers and the work setting are affected as well. For instance, pain impacts the number of hours employees can work and the hourly wages of workers.

The costs of liability for practitioners can be excessive as well. Fitzgibbon (2012) discovered that practitioners expose themselves to tremendous liability when treating chronic pain with medication management. Liability issues related to chronic pain management with medication rose from 2% to 8% of all chronic pain claims in a four year period.

The goal of this literature review is to better understand the problems reported about chronic pain after an orthopedic trauma or surgery and to determine literature findings about methods to curtail this problem when focusing on lumbar laminectomy surgeries.

## Literature Review

The importance of this review is highlighted by a descriptive cohort, level-III, grade B study conducted by Castillo and colleagues (2006) centered on lower limb trauma. Castillo and colleagues assessed pain in a sample of participants using a 10 point rating scale with 1 indicating very little pain and 10 indicating intense pain. They found that nearly one-third of post-operative patients assessed at three months post-operatively rated pain of greater than 4 out of 10 points on the on the scale. Although the focus of the study was on trauma, nearly all of the study participants required surgical intervention. The researchers found that using opioid medications for three months post-discharge was a protective factor against the development of chronic pain.

In addition, Castillo and colleagues (2006) followed 569 post-operative patients between the ages of 18 and 69 years who had suffered from severe lower extremity trauma. They utilized a questionnaire designed to assess the amount of pain each participant experienced following surgery. Subjects were assessed at intervals varying from 3 to 84 months after surgery. Telephone interviews were conducted with participants at the beginning of the study and at 3, 6, 12, 24 and 84 months. Factors taken into consideration included personal health habits, resources and demographics. Following interviews, participants were assigned chronic pain grades of 0-4 and results were tabulated by type of traumatic injury using multivariate analysis. Findings indicated acute pain within a few weeks after an orthopedic injury was the strongest predictor of the advent of a chronic pain state (Castillo, et al., 2006). There were no suggestions about how to treat or intervene during this time period.

In a meta-analysis, Perkins & Kehlet (2000) reviewed over 1700 studies from the late 1990's that covered a three year period. The study focused more on surgical pain than on the

trauma pain itself. They found that an amputation from orthopedic trauma resulted in the prevalence of pain at the three month window ranging from 30% to greater than 80%. The researchers also collected data derived from groups of 25, 50 and 100 patients or more, depending on the type of surgical intervention involved. No specific demographics were reported. The evidence they cited was derived from information collected over long-term periods of greater than two years.

Based on findings of a level-II, grade A, systematic review of randomized-controlled trials (RCTs), Perkins and Kehlet (2000) determined that a major causative factor of chronic pain was neurologic in origin. They labeled this type of pain “phantom pain” although they did not give a reason for use of the “phantom pain” definition. Not unlike Castillo and colleagues (2006), Perkins and Kehlet (2000) found that psychological factors play an important role in the prevalence of chronic pain. Similarly, no determination was made about how an intervention may affect outcomes for this population (Castillo, et al., 2006; Perkins &Kehlet, 2000).

Williamson and colleagues (2009) also conducted a prospective cohort level-II, grade B study with a sample of 1,290 adult patients suffering from orthopedic trauma. Unlike the two previously reviewed studies, these researchers used a numerical pain rating scale to determine level of pain thus reflecting the most common way that most practitioners measure pain based on definitions of Frankel and colleagues, 2011. These researchers also conducted telephone interviews with each patient participant prior to discharge and 6 months afterwards. These researchers also took into consideration the patients’ overall health, and gathered information on psychological status and various demographics. Their analysis of the data was listed in tabular format illustrating that significant pain was present in 48% of orthopedic injury patients at discharge and 30% of the patients six months post hospital discharge. Study limitations included

lack of evaluation of injury status during the follow-up interviews and lack of follow up at more frequent intervals. Williamson and colleagues (2009) described interventions between discharge and the follow-up interviews. They suggested that stated there may be a need for occupational or rehabilitation programs, but there were no additional conclusions perhaps because they did not perform additional interviews at shorter intervals and did not add this type of questioning to the 6 month follow up.

Reuben (2004) systematically studied 140 cases of a specific type of pain in a level-II, grade A, descriptive cohort study. The demographics of the sample of patients were not described. Criteria for inclusion in the study were onset of the condition known as Chronic Regional Pain Syndrome (CRPS) and type of orthopedic trauma/surgery. CPRS is a chronic pain condition that may be recurrent and can be debilitating (Reuben, 2004). The author determined that most CRPS patients develop this problem after having some type of orthopedic surgery. This study is important because of the finding that the main treatment for CRPS is interventional injections which are generally provided at chronic pain clinics. Failure to intervene in a timely manner may affect the ability of providers who are treating the patient in the chronic phase to effectively control pain.

In a descriptive cohort level-II, grade B study by Rivara and colleagues (2008), 3,047 patients in sixty-nine hospitals in the United States between the ages of 18 and 84 years were placed in a cohort to determine whether there was significant chronic pain at 12 months post-injury. Predictors of pain were grouped by body part that was injured, type of injury and surgical intervention. No mention was made about whether the injuries were purely orthopedic in nature, but the most common areas that involved pain were the back, neck and joints. The researchers used a numerical pain rating scale to determine the pain levels. The subject participants were



interviewed at discharge, 3 months, and at 12 month periods. Unlike previous articles reviewed, alcohol and illicit drug use were considered while psychological factors were not. Surgical interventions were not taken into account. The researchers found that approximately 63% of the patients in the study continued to have significant pain during the 12-month period. No mention was made as to the potential for intervention either at discharge or during the interview periods afterwards.

An important study conducted by Martinez, et al. (2007) focused on a very common orthopedic surgery that is conducted routinely around the world. They applied quantitative sensory testing (QST) and evaluated pain responses at 1 and 4 days postoperatively and again at 1 and 4 months to determine levels of pain for total knee arthroplasty patients. The sample for the study consisted of 20 patients with new onset knee problems only. Patients who had used opioids to treat pain in the past were excluded as were those with the existence of mental health issues. Each patient was exposed to stimuli to determine sensitivity and pain response. Measurements of pain, before and after the application of the stimuli, were taken to determine level of pain and pain threshold. Pain was measured with the Visual Acuity Scale (VAS). Findings suggested that 20% of patients continued to have pain at the four month measurement period. Although this finding may not be significant for the determination of chronic pain, it is significant for those with new onset injuries. Although the prospective cohort study, level-II, grade B was based on a small sample size, it was well-designed. One limitation of the small sample size was the skew on gender in that only one male and 19 female participants were included. The average age for the sample was 69 years. Like the other studies, no interventions were suggested or identified to prevent the development of chronic pain.

In a study that included an intervention, Morrison and colleagues (2009) found that steps taken at the time of surgery to decrease pain had an impact on the development of chronic pain. The study sample was 594 patients aged 50 years or older who had undergone either hip fracture repair, total hip arthroplasty of one side only or total knee arthroplasty of one side only. Those with a substance abuse history were excluded from the study as were those with a diagnosis of cancer. Consideration of opioid use was not a study variable. The intervention was based on pain scores and use of analgesia to effectively control pain using a clinical staff of physicians and nurses to keep detailed records on the patients' levels of pain and use of medications for pain relief. Patients were given preemptive analgesia based on a standardized protocol to prevent pain onset when indicated. Patients were unaware if they were part of the study group that used this protocol or the control group that did not have the protocol available to them. Only physiatrists, or physical medicine and rehabilitation specialists, with understanding of the protocols ordered them.

Morrison, et al. (2009), conducted a level-I, grade A prospective propensity score-matched clinical trial. Because it was not a double-blind study, there was a possibility of bias. A multivariate analysis was performed on the results. Findings indicated that pain was decreased from approximately 30% to greater than 50%. As well, chronic pain developed at 6 months in only 4% of intervention patients while 15% of the control group developed the condition. This study was significant in that it illustrated a multidisciplinary approach to treating pain and also indicated that follow-up care makes an impact on the progression to chronic pain. The importance of this double-blind randomized controlled trial by Morrison and colleagues (2009) was that, with some planning and supervision, measures could be taken to prevent the onset of chronic pain in orthopedic patients. While this study was rather narrow in focus for condition and

type of treatment, the results were conclusive that decreased pain scores can be achieved at 6 months postoperatively.

In a focused RCT, Buvanendran, and colleagues (2010) found that one simple intervention could lead to decreased incidences of chronic pain development. Subjects (n=240) were randomly assigned either to the trial or control group and administered perioperative pregabalin after they had undergone a total knee arthroscopy. The patients' ages ranged from 21-80 years. Exclusion criteria included use of non-steroidal anti-inflammatory drugs or pregabalin within the two week period prior to the study, or those with chronic pain or osteoarthritis. Findings indicated that those assigned to the control group reported fewer opioids were needed to control pain.

In a non-pharmacologic prospective cohort study, level-II, grade B intervention based study, Chiono and colleagues (2010) determined that bone grafting procedures often lead to the development of chronic pain. Mean age of the small sample (n=33) was 38.5 years. These researchers evaluated ultrasound nerve block of the transversus abdominis plane to determine if acute pain intervention could lead to fewer patients with chronic pain as a result of anterior iliac crest bone grafting. The researchers found that while this type of procedure was effective in treating pain during and immediately after the procedure, at an 18 month follow up there was no statistical significance in the development of chronic pain between those who had and those who had not undergone treatment. A one-time treatment for pain control does not necessarily reduce or prevent the onset of chronic pain; however it may illustrate the need to follow through with patients to provide other means of pain control.

The final article of this literature review was conducted by Nikolajsen, et al. (2006); The study was designed to determine chronic pain in patients who had undergone total hip

arthroplasty. This study was a level-V in that only a questionnaire was used to obtain input directly from the opinions of those who underwent treatment. The questionnaire was sent to 1,231 patients who had the surgery in the 12-18 month period preceding the study. The average age of these patients was 71.6 years and the majority received either regional or general anesthesia. The response rate in this study was an exceptional 93.6%. Based on respondent reports, findings indicated that 12.1% had a moderate degree of pain chronicity whereas 28.1% reported some level of residual pain. Study findings were significant because chronic pain was found to be pervasive after having had orthopedic surgery or trauma. The authors concluded that little is known about chronic pain after orthopedic surgery and more information was needed to prevent the onset of chronic pain.

### **Discussion**

Based on the articles of this literature review, it is reasonable to conclude that chronic pain after orthopedic trauma with or without surgical intervention is a problem that must be addressed by practitioners. Moreover, the lack of follow-up post-operatively is of notable concern. Only one of the studies reviewed involved a multi-disciplinary approach and all of the studies suggest additional intervention to prevent the onset of chronic pain states.

Chronic pain after an orthopedic trauma or surgery presents a challenge for the patient and provider. Interventions in the post-operative period should be implemented by providers that understand the implications of failure to act. Apfelbaum, et al. (2003) stated that as many as 90% of patients report better pain control with pain medications after having surgery. Nonetheless, the authors state that patients continue to be discharged while still having moderate to severe levels of pain. A program to bridge the gap between the postoperative pain level and treatment in an

outpatient setting may be effective in preventing the development of, or lessening the severity of, a chronic pain state.

Many issues surround the creation of a solution to treatment of orthopedic trauma and acute to chronic treatment of pain. As mentioned by Pasero and McCaffrey (2007), the solution to chronic pain treatment should involve a multi-disciplinary approach across a sizeable timeline. These would include an inpatient pain management team, the patient's primary care provider and the specialists who address the orthopedic trauma. These may include surgeons or generalists in orthopedics. A chronic outpatient pain clinic that is equipped to accept such patients will be the new component that defines the proposed change. Early treatment at such a clinic is meant to bridge the gap that currently exists.

Ensuring coordination between surgeons, post-operative nurses, anesthesiologists and other providers, including advanced practice nurses, would be the responsibility of the inpatient pain management team. The efficacy of such entities has been established over the last several years. More important, the evidence has shown that involvement of these teams improves patient outcomes (Pasero & McCaffrey, 2007; White & Kehlet, 2010). Moreover, involvement of nurses on these teams improves patient outcomes in the control of postoperative pain (Plomano et al., 2008).

Since these teams already exist in many major healthcare institutions, the costs of managing the transition from inpatient management to the outpatient setting should be minimal if not totally offset by reducing costs incurred when treatment is less than optimal. A financial benefit in this endeavor would be the utilization of an advanced practice nurse (APRN) to function as the coordinator between the various entities involved to monitor untoward outcomes. For example, inclusion of an APRN eligible to write prescriptions for opioid medications for a

short period of time and provide follow-up care during the transition stands to off-set chronic pain and resultant long-term treatment. Russell et al., (2002) suggested that data show that an APRN in a similar transitional position provides for improved patient outcomes. Advanced practice providers such as nurse practitioners or physicians' assistants would provide revenue through the billing of services.

Having a properly managed program with personnel well-versed in pain treatment options could result in savings of available healthcare dollars and reduction of costs to the patient. Turk (2002) suggested that proper selection of pain treatment options may result in significant savings across the treatment span of chronic pain patients. He suggests that using modalities such as physical therapy before resorting to further surgeries or expensive pain devices should be considered. These are useful tools in a transitional state.

At this point it is important to understand the expectations of patients. Molding these expectations can result in improved outcomes for patients (Linde et al., 2006). Involvement of patients who previously have had difficulty with orthopedic pain could provide useful. The role of the patient is most important because they must be motivated to make the necessary changes to improve pain.

Mayberry, et al. (2009) suggested that there continue to be barriers to proceeding with surgical intervention in this type of injury. If no surgery has been performed, maintenance of pain control and follow through with treatment will be necessary. It will also be the responsibility of the surgical team to request intervention from an inpatient pain team.

The importance of the educational intervention should not be minimized as evidence overwhelmingly supports the effectiveness of education (Reynolds, 2011; Reynolds, 2009).

Additionally, teaching about pain must be an integral part of the nurse practitioner's role. The

practitioner may need to provide the patient with a short supply of opioid analgesics to ensure proper pain control. Continued treatment would begin within 72 hours at the properly equipped pain clinic that has been informed of the patient's participation and arrival.

Keeping communication open with the patient's primary care provider (PCP) is equally important. If the PCP is not involved, there could be confusion as to medication administration and resultant problems with prescriptions such as double prescribing of opioid medications. Barry, et al. (2010) conducted a study that revealed that many PCPs were happy to have the involvement of an outside entity to help control these types of pain issues. One of the main concerns of PCPs was that of addiction to opioid medication and the subsequent patient problems.

With the addition of an APRN, or other provider, to help with transition from the post-operative setting to a pain clinic, the patient could be enrolled in a program specifically designed to follow through with postoperative pain. The practitioner or clinician who works with the patient prior to discharge may follow the patient to the clinic and continue with treatment there. Having a pain clinic with a psychologist who is knowledgeable about pain management and involved at all stages of treatment is important. Similarly, physical therapy intervention at this point might improve outcomes as well (Rutten et al., 2010). Complementary and alternative medicine interventions may also be used, although they there have been mixed results in clinical trials (Lee & Srinivasa, 2011).

It is important to have a fellowship-trained physician to improve patient outcomes as well (Yeziarski, 2007). Therefore, treatment at the chronic pain clinic would continue under the guidance of a fellowship-trained pain physician until the patient's pain is well controlled and he or she no longer needs opioid pain medication. Communicating with the patient's PCP and

having the patient return there for further treatment will be necessary. There should be an understanding that the patient has the option to return to the pain clinic if he or she feels that the pain has returned.

### **Conclusion**

In any pain management situation, the desired outcome is a patient who is pain free. However, the evidence indicates that currently, most patients suffering from orthopedic trauma or insult have continued problems not only with pain but also with psychological issues in dealing with the pain (Ponsford et al., 2008). Continued involvement of the pain psychologist to help with the patient's mental well-being is critical during treatment. Use of opioid medications for a brief time can only be effective and without addiction issues as long as there is significant pain (Ballantyne & LaForge, 2007). Rapid transition from opioids to other treatment methods and continued participation by the patient are desirable major goals as well.

Another desirable outcome is the patient's return to normal function levels. Slater, et al. (2009) found that early intervention and attention to pain control, psychological well-being and physical fitness resulted in an improved recovery time for patients and decreased disability. The mechanisms for the inclusion of nurse practitioner led interventions can meet the desired outcomes and possibly provide a platform for improving existing methods of controlling orthopedic pain and preventing the onset of chronic pain.

Improved pain scores and mental well-being should be of utmost concern to providers. The addition of a transitional pain care entity, led by nurse practitioners, to an existing health care model could prove to be beneficial to patients and care givers. Furthermore, costs could be minimized by using highly trained existing staff member and facilities and revenues may be increased by decreasing length of hospital stay and billing for practitioners time in direct care.



Nonetheless, the main focus is on the overall health of the patients and based on the evidence of this review; improving outcomes for these patients can be achieved.

Currently, there is a gap in the care of chronic pain patients. Because of this gap, unmonitored patients may be in danger of becoming tolerant or addicted to opioid medications and the development of chronic pain goes unchecked. There is no reason not to attempt a remedy for these serious issues. Table 1 summarizes recommendations of practice. As indicated, nurses and other health care professional must attempt to intervene with this patient population and to improve management of post-operative pain.

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**Table 1- Recommendations for Practice**

- Involvement of a multi-disciplinary team beginning with admission of orthopedic trauma patients
- Collaboration between surgeons, internists, pharmacy, pain management and nursing before, during and after a surgical intervention
- Appointment of an advanced practice nurse to follow the patient and provide professional advice to guide the pain management of each patient in this population
- Development of a comprehensive plan to ensure continuity of care before and after discharge
- Admission to an interventional or chronic pain outpatient clinic with a program to familiarize patients with the setting in the event chronic pain develops
- Assurance to the patient that issues of pain will be dealt with along the continuum of care
- Prevention of overuse of opioid medications to control pain and use of other pain control methods found effective by the evidence.

Manuscript II

The Relevance of Utilizing Transitional Care for Post-Laminectomy Back Surgery Patients

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### Abstract

Transitional care is becoming a welcome and necessary part of today's healthcare system. For patients who have had lumbar laminectomy surgery, there is currently no type of formal transitional component in place that might help them successfully transition into a pain free state. Because of the lack of such a component, many could develop chronic pain. The purpose of this paper is to review a few existing transitional care programs and present some reasons why applying the same principals could be beneficial to those who have undergone this type of surgery. In addition, opioid use for controlling post-operative pain is explored as this is a major concern due to the fact that there is often little monitoring after surgery for post-laminectomy patients. Dangers from this lack of monitoring are a key aspect of the review. Finally, a recommendation to develop a transitional program that follows post-laminectomy back surgery patients will be presented with explanations of possible benefits. Following the principals of transitional programs that have already been proven to be effective, this type of new element may prove to be a valuable tool in curbing the onset and development of chronic pain.



## **The Relevance of Utilizing Transitional Care for Post-Laminectomy Back Surgery Patients**

The importance of managing postoperative pain cannot be ignored. In recent years, postoperative pain management using a multi-modal approach has become commonplace in most American healthcare facilities (Pasero & McCaffrey, 2007). Pasero and McCaffrey (2007) also underscore the importance of communicating with a patient's primary care provider to outline a plan of treatment that begins prior to the surgery and continues afterwards. Unfortunately, many trauma incidents do not allow time for such planning. Additionally, there is a dearth of information on the availability of programs that address pain management in transition between inpatient and outpatient status.

Ganapathy and Brookes (2011) suggested that lack of intervention during the crucial first few weeks after orthopedic surgery may lead to development of associated disorders such as phantom limb pain or chronic regional pain syndrome. According to the authors, after these conditions have developed, management of pain becomes very difficult. Yarnitsky and colleagues (2008) further advise that preparation and early intervention could substantially reduce pain and be supported with scored instruments in this patient population. They postulate that treatment and prevention of chronic pain states should begin prior to surgery and continue well after discharge of the patient. It appears that failure to maintain continuity of care from initial trauma to post-discharge from the hospital can result in ineffective pain management and possible development to a chronic pain state.

For many patients, a primary care provider is the only source of treatment once they have been discharged after an orthopedic trauma inpatient stay. While many providers work diligently

to control chronic pain conditions, many are ill equipped to deal with the situation. For example, the University of Kentucky and four others settings are the only institutions, out of 133 medical schools in the U.S., to require courses in pain management (Roehr, 2011). Further a literature search failed to locate any reference to a nursing school that either required or offered an elective course in pain management, and Oregon (The Oregon Pain Management Commission, n.d.) was the only state that requires nurses to have continuing education credits in pain management.

While preparedness to prevent the onset of chronic pain is a barrier that must be addressed, cultural considerations for the patient must be considered as well. Pain management clinics can be a vital resource in the range of treatment sites and are visible in every community. They are often viewed in a negative light in the midst of illegal activities, such as selling of prescriptions, throughout the state of Kentucky and the U.S (Centers for Disease Control, 2011). This has become such a problem that legislation is pending in many jurisdictions to combat the problems of prescription drug abuse (Kegley, Honeycutt & Estep, 2011). However, legitimate pain clinics that follow appropriate guidelines and employ highly trained providers can be an effective way of treating chronic pain conditions (Baker & Lane, 2010; Manchikanti et al., 2010). Pain fellowship training for physicians and experienced advanced practice nurses or physician assistants are the foundation of these clinics. As data increase about the phenomenon of pain clinics, it is vital that these providers become part of the solution to timely and effective treatment of post-surgical orthopedic patients (Schneider, 2008).

The purpose of this paper is to report on the importance of monitoring patients taking opioids to control post-laminectomy pain to prevent over use and misuse of these medications. A specific aim of the paper is to consider a program the benefits of the Transitional Care Model led by advanced practice nurses for this vulnerable population who is at risk for inadequate care.

## The Opioid Issue

Many patients with low back pain who are admitted to any hospital are those resulting from trauma to, or degradation of, the lumbar spine. These types of conditions can be painful and enduring. Often, such injuries are treated with opioid medications that have severe and dangerous side effects and must be monitored closely. When a patient has laminectomy surgery and is ready for discharge from the hospital, he or she is routinely given a prescription for these medications for a short period of time. Fields (2007) describes this issue of grave concern emphasizing that opioids affect areas of the brain that react to rewards, such as eating when hungry. Taking these medications for extended periods of time create responses in the human body that may lead to addiction issues. Garland, et al. (2013) state that as many as 10% of those who take opioids will develop addiction problems.

Unfortunately, the pain can last longer than the prescription for which it was written. According to Manchikanti, et al. (2011) opioids have not been shown to be effective in allowing the patient to return to functional status. Patients may begin to rely solely on these medications for pain relief, causing concerns for primary care providers who no longer will prescribe opioids for extended periods of time. If this happens, the patient may feel forced to rely on an emergency department or illegal means to provide a remedy for the pain.

Nonetheless, after a laminectomy surgery, patients are often treated with oral opioid medications for a few days. Afterwards, patients are routinely left to depend on primary care providers to manage the pain. Chronic pain may develop during this time, making continuity of care an important factor in the treatment of post-laminectomy patients. It is incumbent on those

providing treatment to provide proper follow up during this period to avoid the many pitfalls that could occur.

Adamson, et al. (2011) discussed the pitfalls of using opioids once the patient is discharged and cannot be effectively monitored. At risk patients such as those who are obese or suffer from sleep apnea are of particular concern. Jamsion, Serrailier and Michna (2011) noted that adverse effects could result in bowel dysfunction, endocrine deficiencies and cardiac arrhythmias. Healthy patients may be at risk as well for dependency issues. Without proper monitoring these conditions may lead to devastating consequences. These authors suggest the need for intervention before dependency issues arise.

### **Psychological Aspects**

The psychological implications of opioid use are also of significant importance. Prior to engaging in prescribing opioid medications, the provider must know the psychological history of the person being treated since there is a correlation between psychological issues and misuse of opioid therapy in the long-term (Chou, et al., 2009). However, there is no definite way to predict how all patients will respond psychologically when exposed to these medications for extended periods of time (Turk, Swanson & Gatchel, 2008). Continuous monitoring in a proper setting such as a chronic pain treatment clinic with the availability of a pain psychologist, could be an effective way of dealing with this issue (Stanos, S., 2012).

### **Hyperalgesia**

Lee, et al. (2011) describes an additional issue that is becoming more prevalent, opioid-induced hyperalgesia (OIH). The authors define this condition as “a state of nociceptive

sensitization caused by exposure to opioids. This condition is characterized by a very high pain score despite continued increases in opioid medications. In other words, these medications actually intensify rather than reduce the pain. Even so, patients may insist that they must have the medications to keep their pain under control. The only treatment for OIH is gradual reduction in the amount of opioid intake to prevent withdrawal. Patients will routinely reject this notion but report lower pain scores once they have been tapered off the medications. Monitoring by trained professionals is of paramount importance in this aspect of treatment.

Clarke and colleagues (2009) stress how misunderstood the transitional phase from post-surgical pain to development of chronic pain is for providers. The authors explain the importance of a comprehensive plan, carried out by a multi-disciplinary team to prevent the onset of chronic pain, development of neuropathic pain, phantom limb syndrome and other conditions. Adamson and colleagues (2011) stress the importance of preventing a dependence on opioid medications, which is a major concern in the healthcare field today. Crofford (2010) recommended that use of these medications should include constant evaluation and re-evaluation to avoid negative effects. However, the authors did not comment about the benefits of having a transitional provider in place to coordinate the multi-disciplinary team. This topic warrants exploration.

### **Conceptual Framework: Transitional Care Models**

Transitional care is now a significant factor in any healthcare system. Naylor, et al. (2011) outlined this significance of the model when discussing the implementation of the Affordable Care Act (ACA). For example, Naylor and colleagues focused on how patients become vulnerable during transitions from locations and stages of care emphasizing effective

transitional elements can be in ensuring continuity of care. They further stated that nurses, especially advanced practice nurses will be vital in the implementation of transitional programs.

Transitional care models have been implemented in treatment interventions for many chronic disorders with significant positive results. Naylor, et al. (2004) found that applying a transitional care model guided by an advanced practice nurse (APN) increased time between admissions of patients with chronic heart failure. Their important findings indicated that the number of re-hospitalizations were fewer, medical costs were less and patient quality of life had improved significantly. The success of transitional care spearheaded by APNs resulted in attention of the Centers for Medicare Services (CMS). Today, payment strategies for such programs are in development as the cost savings in the long-term have been recognized (Stauffer, et al., 2011).

One of the more recognized transitional care models is used with patients who have suffered from myocardial infarction. Often these patients undergo coronary artery bypass graft and must have care for a significant amount of time. Transitional care has shortened hospital stays significantly and decreased the amount of time for recovery. Starting the transitional process in the hospital and following it through to home care resulted in a decrease in re-hospitalizations and emergency room visits (Bettger, et al., 2012). Healthcare cost reduction is yet another positive outcome of transitional care.

The costs of healthcare are a major concern, especially those related to chronic conditions. Diabetes care has become one of the better known successes using the transitional care model. Intervention begins with prevention and follows through to care of those who require intensive treatment. Li and colleagues (2010) found that diabetes costs topped \$174 million dollars in 2007 and that intervention by providers grounded in understanding treatment and

preventive interventions could reduce cost significantly. There is also a statistically significant impact on the control of diabetes with proper management and follow-up. Pimouguet, and colleagues (2011) extensively reviewed disease management programs for diabetes and found that frequent contact with patients resulted in significantly lower hemoglobin A1c scores. While initial contact may not be made in the hospital with this transitional model as it is with others, the premise remains the same.

Bradway, et al. (2011) found that incorporating APNs when implementing the transitional care model for chronic disease states was overwhelmingly successful because APNs were more available to the patients and tended to provide more comprehensive care. The authors compared these findings to transitional care models that utilized multiple care givers without the direction of an APN and discovered that the lack of communication and coordination was significant. Using a dedicated transition provider in post-discharge strategy, usually nursing led, resulted in improved outcomes for patients, and specifically reduced readmission rates and fewer visits to emergency departments (Rennke, et al., 2013).

Following in the footsteps of programs such as the ones mentioned, development of a transitional program that addresses the needs of post-surgical orthopedic patients, especially those who have undergone lumbar laminectomy surgery, should be a viable alternative to the current way pain is dealt with.

### **A Proposal for Change**

Clearly, the problem of developing chronic pain after an orthopedic trauma or surgery has been emphasized in the literature. Apfelbaum, et al. (2003) reported that as few as 10% of patients do not have better pain scores when taking pain medications after surgery. Patients, however, continue to have pain, even if it is improved in the short term. A program, led by

advanced practice nurses, could pose a solution to this problem, or at least contribute to lower pain levels of the patients affected. Change should begin with identifying those who would be affected by, and benefit from, such a program.

### **Stakeholders**

The major stakeholders involved in a plan to develop a transitional element between inpatient and outpatient pain management begins with the overwhelming number of patients undergoing orthopedic surgeries in the United States. Among Medicare beneficiaries alone, there were 124,986 knee replacements in 2000 (Mahomed et al., 2005) and in 2003, the number of partial or total hip replacement surgeries exceeded 300,000 (Zhan et al., 2007). These are only two of many types of orthopedic problems requiring surgery. Major considerations for these patients are not only the persistent pain in the days or weeks after surgery, but also the development of chronic pain. Williamson and colleagues (2009) estimated that significant pain was present in 48% of orthopedic injury patients at discharge and 30% 6 months following release from the hospital.

Other major stakeholders would be the primary care physician, admitting physician, nursing staff, surgeon, inpatient (acute) pain provider, pain management nurses, hospital administration, outpatient (chronic) pain provider, a pain psychologist, outpatient clinic staff and rehabilitative services or home health services personnel, if any. Each stakeholder would play a major role in program planning and administration. The stakeholder who could bring all of the others together should be an advanced practice nurse with a background in pain management. The APN would coordinate all activities with the other stakeholders and take lead in patient care.



Another factor to consider prior to implementing any plan is evaluation of the underlying values of the stakeholders. Opioids are an effective tool in treating orthopedic pain yet opioids are often viewed in a negative light, not only by patients, but by nurses and physicians as well (Broekmans, 2011). Although care providers may know that these are effective medications, their own beliefs could result in a negative reaction to a patient. Each stakeholder must understand his or her own values and beliefs prior to participation in an effective program.

### **Implications for Change**

For the aforementioned stakeholders, the implications of change that would be brought about by implementation of this plan must be emphasized. Schein (2010) outlines ten steps in conducting a cultural assessment when implementing a managed organizational change. The plan begins with having leadership, in this case administration, commit to the change. The process continues with assessing willingness to change and meeting with major stakeholders to discuss each participant's values and assumptions about what is happening. It concludes with deciding on how to proceed. Schein (2010) outlines these values in his three levels of culture. He states it is important to know the true ideals of the participants by studying the stated values of each, their rationalizations, and their behaviors in relation to such beliefs. This will be an important factor in successful implementation of a plan to create a transitional element between inpatient and outpatient treatment of pain.

### **Change Theory**

Change theory must also be considered prior to implementation. The use of opioids is an integral part of controlling pain in the acute care setting. Avoiding difficulties with these

medications will be of paramount importance during the time between discharge and on-going chronic pain treatment. Understanding the stages of change theory is necessary for not only for the patient who has developed addiction and or tolerance to opioid medications, but also for chronic pain providers who must be knowledgeable on the subject. According to Murphy, et al. (2009) having a psychologist involved early in the inpatient setting, may minimize overuse, abuse or inappropriate use of medication issues at latter stages. Early intervention by a psychologist in the outpatient clinic also minimizes aberrant behavior (Moore et al., 2009). According to Thomas and colleagues. (2012) the Transtheoretical Model of Change developed by Prochaska and DiClemente (1984) is very effective for assessing the motivation of a patient to change. An in-depth understanding of these concepts is vital to preventing or addressing problems with opioid addiction, misuse and tolerance.

### **Systems Change**

Many issues surround the creation of a solution to treatment of orthopedic trauma and acute to chronic treatment of pain. As mentioned by Pasero and McCaffrey (2007), the solution would involve a multi-disciplinary approach across a projected timeline that is likely to be lengthy. This macrosystem change fits well within the chronic care model developed by Wagner (Nelson, et al., 2011, pp. 255-8).

The development of a transitional pain element also would involve adding an inpatient pain management team, the patient's primary care provider and the specialists who address the orthopedic trauma. These may include surgeons or generalists in orthopedics. A chronic outpatient pain clinic that is equipped to accept such patients will be the new microsystem that

defines the proposed change. Early involvement of such a clinic is meant to bridge the gap that currently exists.

Ensuring coordination of the aforementioned microsystems would be the responsibility of the inpatient pain management team. The efficacy of such entities has been established over the last several years. Evidence has shown that involvement of these teams improves patient outcomes (Pasero & McCaffrey, 2007; White & Kehlet, 2010). Moreover, involvement of nurses on these teams improves patient outcomes in the control of postoperative pain (Plomano et al., 2008).

### **Evaluation**

Evaluation of the transitional element at every stage is crucial in ensuring success. Thus, measuring outcomes is crucial in any evaluation plan. Using a multi-layer approach to measurement, such as the one described by Nelson, et al. (2011) to determine the patient's response to focused interventions such as opioid administration will be beneficial. Determining if specific care processes, such as counseling by the pain psychologist or other interventions by care givers, are effective is also an important consideration. According to Nelson, et al. (2011), this is a continuous process.

Measuring outcomes will involve choosing methods for measuring pain, functional ability and psychological well-being. Traditional methods such as a numerical pain scale should be evaluated as pain impact measurements have been determined to be beneficial and informative (Frankel et al., 2011). Psychological evaluations are many and varied. Leo, Quinton and Ebert (2011) list some effective methods for evaluating and measuring psychological factors of pain. These range from a brief pain inventory to personality inventory to a survey of pain attitudes (SOPA). One of the more commonly used measures is the PHQ-9 questionnaire that

was validated by Kroenke, Spitzer and Williams (2001). Measurement of functional ability would be the purview of physical or occupational therapy professionals or a psychiatrist if one is involved. The Oswestry Disability Index described by Fairbank and Pynsent (2000), relates directly to the functional ability of those with spinal issues and could be a reliable way to measure functionality of post-laminectomy patients. Table 1, shows how specific outcomes would be measured using selected validated instruments.

At the higher levels of the meso and macrosystems , performance reviews and reports will be monitored. The administrator in charge of the transitional element should also report on cost-effectiveness and financial stability. All involved should be cognizant of institutional rules and regulations and report any deviations or questionable activity. Information collection and dissemination via computer will be a valuable tool. All care providers should be able to view progress reports, medication usage information, etc. for continued evaluation. They should also be able to give and receive input at all points in the continuum of care. All information should be clear and concise as to not overload participants with unnecessary information.

### **Conclusion**

Improvement in pain reduction and enhanced mental health well-being should be of utmost concern to providers. The addition of a transitional pain care entity to an existing health care model could prove to be beneficial to patients and care givers. The costs could be minimized by using highly trained existing staff member and facilities. Revenues may be increased by decreasing length of hospital stays and billing for providers involved. But the main focus should be on the overall health of the patients. Improving outcomes for these patients can be achieved based on the evidence provided.

Currently, there is a gap in the care of these patients. Because of this gap, patients who are not monitored may be in danger of becoming tolerant or addicted to opioid medications. Providers have a responsibility to address these serious issues. It is the responsibility of every nurse and health care professional to attempt to intervene and help this patient population.

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Zhan, C., et al. (2007). Incidence and short-term outcomes of primary and revision hip replacement in the United States. *The Journal of Bone & Joint Surgery*, 89(3), 526-33.

**Table 1*****Select Instruments for Use in Comprehensive Chronic Pain Management***

<b>Evaluation Variable</b>	<b>Validated Test</b>	<b>Scoring</b>
Functional Ability	Oswestry Disability Index	0%-20% : Minimal Disability 21%-40%: Moderate Disability 41%-60%: Severe Disability 61%-80%: Crippling Back Pain 81%-100%: Bedfast or Exaggeration of Symptoms
Pain	Numerical Pain Scale	0: No Pain 1-3: Minimal Pain 4-6: Moderate Pain 7-9: Severe Pain 10: Unbearable Pain
Psychological State	PHQ-9 Depression Inventory	1-4: Minimal Depression 5-9: Mild Depression 10-14: Moderate Depression 15-19: Moderately Severe Depression 20-27: Severe Depression

Manuscript III

Analysis of the Transitional State between Acute and Chronic Pain for Post-Lumbar  
Laminectomy Patients

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In partial fulfillment of requirements for  
the Doctor of Nursing Practice (DNP) Practice Inquiry Project

### **Consent and Privacy**

This Practice Inquiry project was approved by the Institutional Review Board (IRB) at the University of Kentucky prior to implementing the study. All IRB approved procedures were observed diligently and the privacy of all participants was upheld during all phases of the project. Data were collected during a review of charts and self-report responses to questions presented to participant subjects enrolled in the study. Data were stored on an encrypted computer approved by the University, or on paper forms which were kept in a locked file on University property when not in use. There were no changes made in treatment, no costs and no compensation for participants who were given the right to opt out of the study at any time.

### Abstract

In the United States, 74.6% of patients who have lumbar laminectomy surgery have residual low back pain (Hussain & Erdek, 2014) and overall costs of low back pain may reach up to \$200 billion per year (Carey & Freburger 2013). To further address this problem, a study was conducted to determine if treatment in a chronic pain clinic could result in a reduction in the development of a chronic pain state for adult patients who have had lumbar laminectomy surgeries. A convenience sample of 50 patients was selected from the Interventional Pain Associates clinic at the University of Kentucky. Records were collected from electronic patient charts. A self-administered questionnaire was used to determine several variables including amount of time it took for patients to be seen in a pain clinic after a lumbar laminectomy surgery, type of treatment received for pain and whether they had been offered pain treatment at discharge from surgery. Demographic data were collected to determine age, sex, smoking status and history of anxiety and/or depression. Findings indicated that most of the subjects were treated for pain post-operatively either by the surgeon who had performed the laminectomy or by a primary care provider. Results also indicated that only 38% of the participants were offered any form of pain treatment after surgery while 90% said they would have accepted a referral to a pain clinic. There was a correlation between the amount of time it took to be seen in a pain clinic and the level of improvement in pain. Changes in pain measurement scores indicated that the earlier the subjects were seen in the pain clinic the lower their pain scores were. To better understand these relationships, additional research with larger sample sizes at various treatment locations is warranted.

## **Analysis of the Transitional State between Acute and Chronic Pain for Post Lumbar Laminectomy Patients**

Patients admitted to an acute care setting for orthopedic injuries often require surgery for correction of their health problem. In addition, morbidity and mortality rates vary greatly depending on the type of trauma, surgical intervention or co-morbid conditions for these patients. Many patients recover without incident and 68% of the population returns to work after only six months (Clay, et al., 2010). Unfortunately, many others have long-term problems. For instance, 74.6% of the patients requiring lumbar laminectomy surgery had residual low back pain (Hussain & Erdek, 2014). This is of grave concern since the number of these surgeries was nearly 250,000 in the U.S. in 2002. Despite these numbers, there are reliable and effective treatments for patients who have post-laminectomy back pain including epidural steroid injections and intrathecal opioid therapy (Urbana-Champaign & Manchinkanti, 2013 and Hayek, et al., 2011).

Multiple sources have reported the effectiveness of interventional pain treatments for post-laminectomy patients (Civelek, et al., 2012; Manchikanti, et al., 2010; Abdi, et al., 2007 and Kumar, Malik & Demeria, 2002). Treatment interventions include epidural steroid injections, spinal cord stimulator placement and facet nerve blocks. These types of treatments are considered fundamental interventions at most pain treatment centers. However, many pain treatment centers offer a more holistic approach with psychological support that has also been shown to be effective in the treatment of pain (Buhrman, et al., 2011).

Carey and Freburger (2013) estimate the costs of low back pain in the U.S. to be between \$100 and \$200 billion each year. With effective interventions, in a timely manner, these costs can be significantly reduced. Okifuji, Turk and Kalauokalani (2013) suggest that early



intervention in a multi-disciplinary pain treatment center can save as much as \$200,000 per patient for a total of over \$5 billion per year for those treated in facilities who offer effective interventions. It should be noted that this is the savings for all patients seen in pain clinics including those with post-laminectomy pain. Still, there are gaps in our knowledge base.

### **Gaps in Knowledge**

In many acute care settings, the current solution for preventing pain is to prescribe pain medications for a brief period of time after a patient has had a lumbar laminectomy surgery (White & Kehlet, 2010). Some practitioners follow up and continue with post-op pain management for several weeks while others prefer to have the patient's primary care provider assume pain management. Reuben (2004) suggests that an intervention at a chronic pain clinic may be beneficial. The interventions may well include pain medications but will also employ other methods such as injective therapy, i.e. epidural steroid injections, referral to physical therapy, or one of many other treatments. In a literature review of interventions for various post-operative orthopedic conditions, Calhoun (2014) found no significant references that addressed any all-inclusive solutions to the problem of continuity of care amongst this population.

Acute pain practitioners, in conjunction with a chronic pain clinic, may be effective in assisting patients in transition after an orthopedic surgery like lumbar laminectomy. The intervention would involve close monitoring during follow-up from the inpatient setting to a pain clinic. In sum, the acute care practitioner would guide continuity of care. Therefore, the purpose of this study was to determine if treatment in a chronic pain clinic could result in a reduction in the development of a chronic pain state for adult patients who have had lumbar laminectomy surgeries.

### Theoretical Frameworks

Two frameworks were reviewed for this study: the Continuity of Care Model (Abraham, Kannampallil & Patel, 2012) and Transitional Care Model (Naylor & Van Cleave, 2010). As suggested in the title of the model, Abraham and colleagues addressed lack of continuity in their work. They proposed a clinician centered approach to ensure there was a collaborative effort for uninterrupted care of the patient. In addition, the Naylor and Van Cleave (2010) work on transition has potential for a supporting role by an advanced practitioner in development of a long-range plan to create the transitional element provided data support doing so.

The Continuity of Care Model is essential for pain management because time is a factor in treating pain. Having providers that understand the level of a patient's pain will save time in the evaluation process as well as avoid repeated treatments the patient may not remember having or allowing repeated treatments due to lack of knowledge about the processes involved. The transitional care model is important because patients may be reluctant to seek out pain management for fear of being viewed as drug seekers. If a systematic process is in place that ensures follow-up after surgery, the patients will have appointments and visits in place with qualified providers to ensure pain is being addressed.

### **Study Design**

A descriptive, retrospective study design guided this project. Basic demographic information was obtained from a chart review of patients who had undergone lumbar laminectomy surgery and had been seen in an interventional, multi-disciplinary pain clinic after discharge from the hospital. The study was conducted over a three month period in early 2014. There was no time limit between discharge and treatment in the clinic. Pain levels were determined by using a standard Visual Analog Scale (VAS) (Appendix 1); high reliability for measuring pain has been reported when using the VAS (Bijur, Silver & Gallagher, 2001). In addition to the VAS, data were collected from the subjects about types of pain treatment after discharge, type of surgery performed and any other pertinent data that influenced the intervention.

### **Sample and Methodology**

A convenience sample of 50 post-operative lumbar laminectomy patients who had developed chronic pain and were treated at the University of Kentucky Interventional Pain Associates clinic in Lexington, Kentucky was selected at random if they had undergone lumbar laminectomy surgery. A self-report questionnaire was given to each of the subjects (appendix 2). Subjects were given adequate time to answer all questions either by reading on their own or being read the questions. In addition, a chart review of the subjects' medical record was conducted to obtain additional demographic and historical information. Inclusion criteria were: first lumbar laminectomy surgery, ability to read and understand simple questions posed in the form of a questionnaire, and willingness to participate in the study. Exclusion criteria were: inability or unwillingness to participate in the study, multiple orthopedic surgeries that might

affect pain scores, current uncontrolled co-morbid conditions, pregnancy and aged under 18 years.

Twenty-five females and twenty-six males were offered the opportunity to participate in the study; one male opted out before completing the questionnaire and answers were destroyed as requested. Subjects' ages ranged from 28 to 83 years of age; all had undergone lumbar laminectomy surgery. Co-morbid conditions such as diabetes or heart disease were not considered, unless they were uncontrolled, nor were race, access to care for financial concerns, other orthopedic surgeries not involving the lumbar spine and time already spent in pain clinics. However, smoking status and history of anxiety and or depression were considered.

All data collected were analyzed using SPSS 22 software (©1989, 2013, IBM Corporation). There were no missing data. In addition, answers concerning time from discharge to treatment in a pain clinic were converted from various answers such as weeks, months, days or years to months only to make tabulation more accessible.

### **Data Analysis**

#### **Frequencies of Subject Responses**

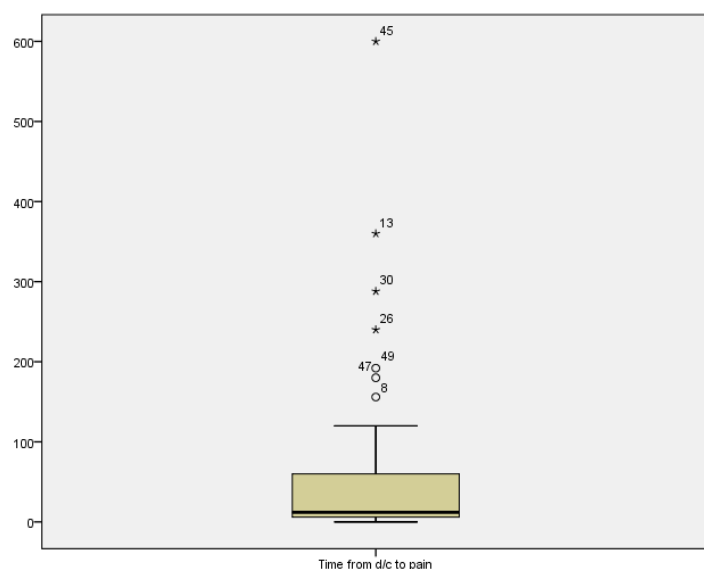
As indicated in Table 1, only two subjects reported that they had not received some type of opioid analgesic such as morphine, Demerol, hydromorphone, Percocet, etc. Ninety-six percent of subjects reported needing opioids for pain control. The type and route of medication was not considered. The majority (n=41; 82%), reported current use of oral opioid medications for pain control. Most (n=31; 62%), stated they were not offered any form of pain treatment at discharge and 90% (n=45) reported they would have accepted referral to a pain clinic had it been offered. Roughly half (n= 26; 52%) reported their pain was controlled at discharge, but only 32% (n=16) responded that they felt their pain had improved during that period of time (Table 1).

Only 38% (n=19) of the subjects were offered any form of pain treatment at discharge and the remaining 62% (n=31) reported pain treatment only after requesting it during follow-up or referral visits. The extraneous factors of smoking and a history of anxiety and/or depression are further analyzed and are reported in a latter section of the findings.

### Time from Discharge to Pain Clinic

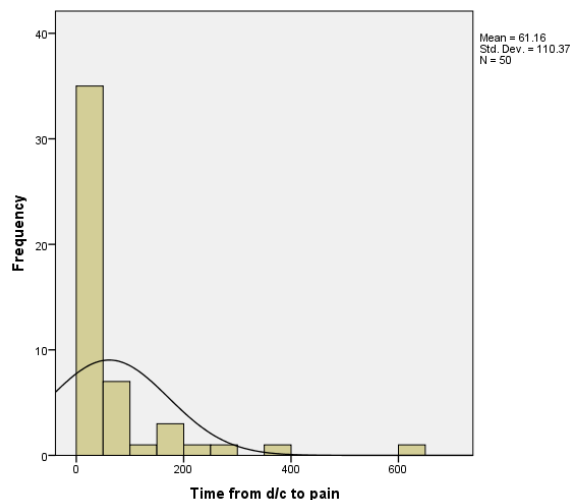
The amount of time it took for patients to be seen, after discharge from surgery, in a pain clinic varied significantly from within a few days to 50 years, or 600 months. The median time for the population was 12 months and the mean was 61.16 months (Graph 1). A 95% confidence interval, for the mean, set the lower bound at 29.79 months and upper at 92.52 months. A 5% trimmed mean was adjusted for several outliers and the result was 43.42 months. Skewness was positively high due to the outliers at 3.176 (Graph 3). The box-plot graph below represents the output data, time is in months.

Graph 1



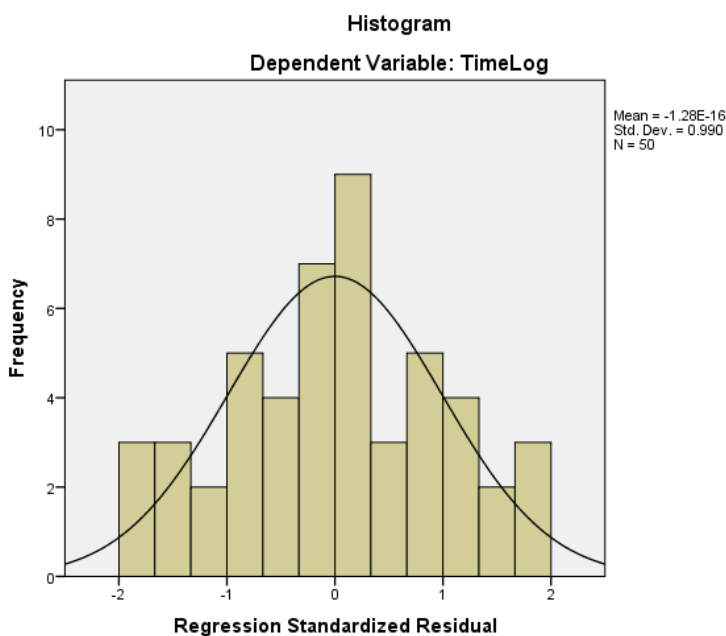
When grouping and comparing VAS scores for those who were seen in a pain clinic within 12 months of discharge from surgery ( $n=26$ ) with those who took longer than 12 months ( $n=22$ ), those seen in a more timely manner had an overall average decrease of -2.02 on their pain scores versus an increase in pain scores by +0.7 for those who took an extended amount of time to be seen. Scores for two subjects were not included because the subjects were both being seen in a pain clinic for the first time and had yet to be treated. Interestingly, both of these subjects were seen within 12 months and each had significantly higher VAS scores post-surgery, with +7 and +3.5 higher pain reported on the VAS. Time from discharge from surgery admission was analyzed with differences in pain scores. Outliers were omitted if the time from discharge to the pain clinic was greater than 10 years. There was a moderate positive correlation of  $r=0.310$  with a significance of  $p<0.05$  (0.043). Even with the outliers included,  $r=0.269$  significance was  $p=0.059$ . This may suggest that the longer it takes to be seen in a pain treatment facility, the higher the levels of pain tend to be based on the current level of pain. Due to the small sample size a multiple regression analysis was conducted. As shown in Graph 2, there is a definite skewness for the cases that were available likely due to the small sample size.

Graph 2



However, to determine a normal distribution as may be expected with a larger sample, the logarithm of time samples can be obtained and applied in the regression analysis to get the following output. This analysis results in a more normal distribution, as shown in Graph 3.

Graph 3



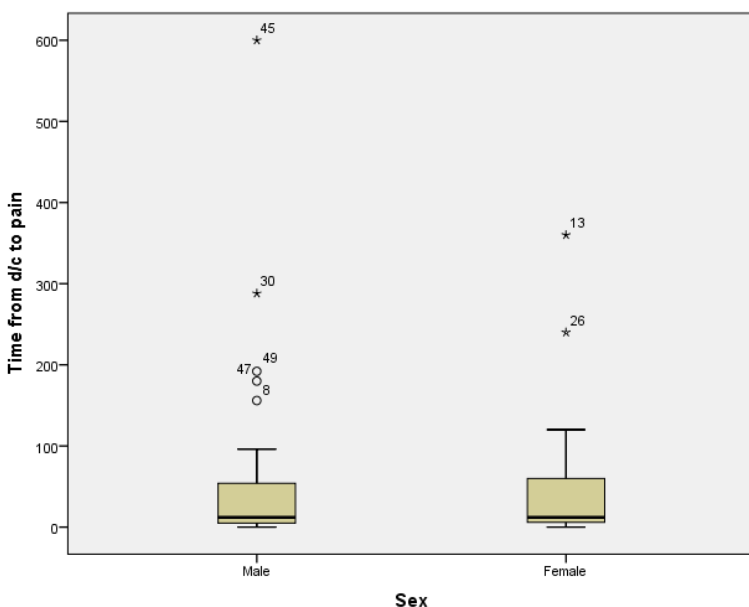
Using this information, one can speculate that a larger sample size may confirm correlation. The Pearson's  $r=0.281$  with a statistical significance of  $p<0.05$  (0.024) when regression analysis is

performed, shows that a normal distribution is expected with the larger sample size. This data includes all outliers. With this knowledge, we can reasonably assume that the longer it takes to be seen in a pain clinic after discharge, the greater a patient's pain will be.

### Age and Sex of Subjects

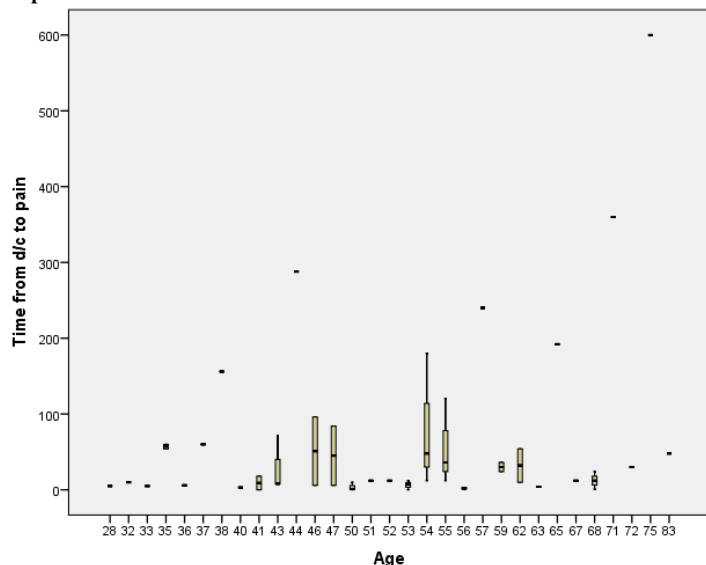
No statistical significance,  $p > 0.05$ , was found in the correlation between amount of time it took for females vs. males to be seen (Graph 4). Assuming a normal age distribution for gender in the sample, Pearson's coefficient of correlation demonstrated an  $r = .288$  and  $p < 0.05$ , showing a weak to moderate relationship between age and gender. This finding indicates that the older the subject, the less likely to be seen in a pain clinic (Graph 5).

Graph 4





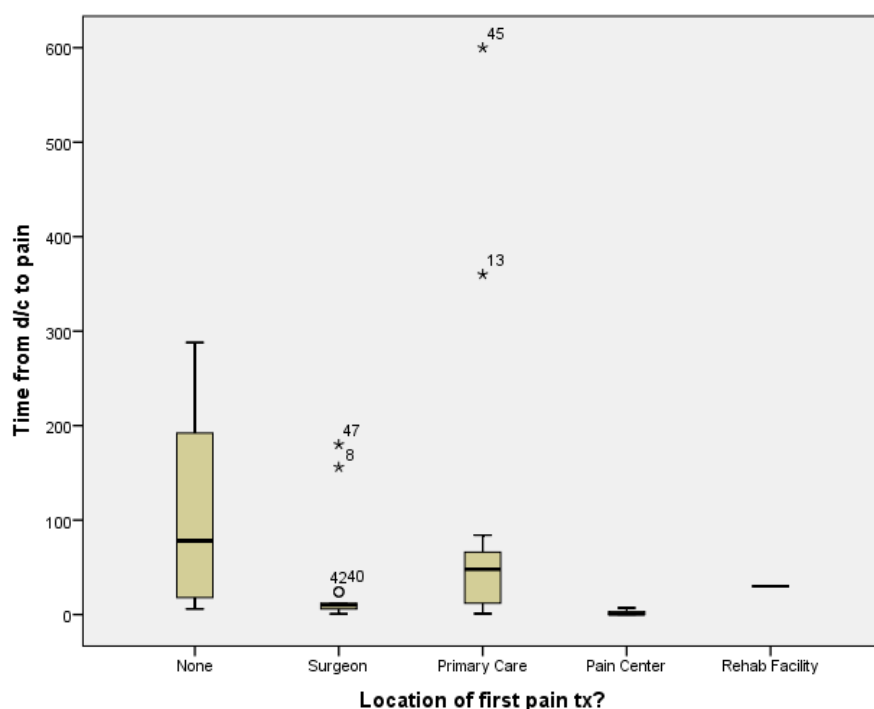
Graph 5



### Location of First Pain Treatment after Surgery

The location of the subjects' first pain treatment was a significant factor in the amount of time it took to be seen in a pain clinic. Participants were questioned to determine if they were referred after surgery for pain control and location or type of referral. Table 2 shows the locations where subjects were first seen and the mean for how long it took to be seen at the same site post discharge from surgery. Interestingly, if the patient was first seen in a pain clinic after surgery for pain control, the mean time was only 1.8 months, while it was 27.4 months to be seen in a surgeon's office, 30 months for a rehabilitation center, 96 months for a primary care provider and 108 months if no referral was given at all. Graph 6 represents this output in box-plot format.

Graph 6

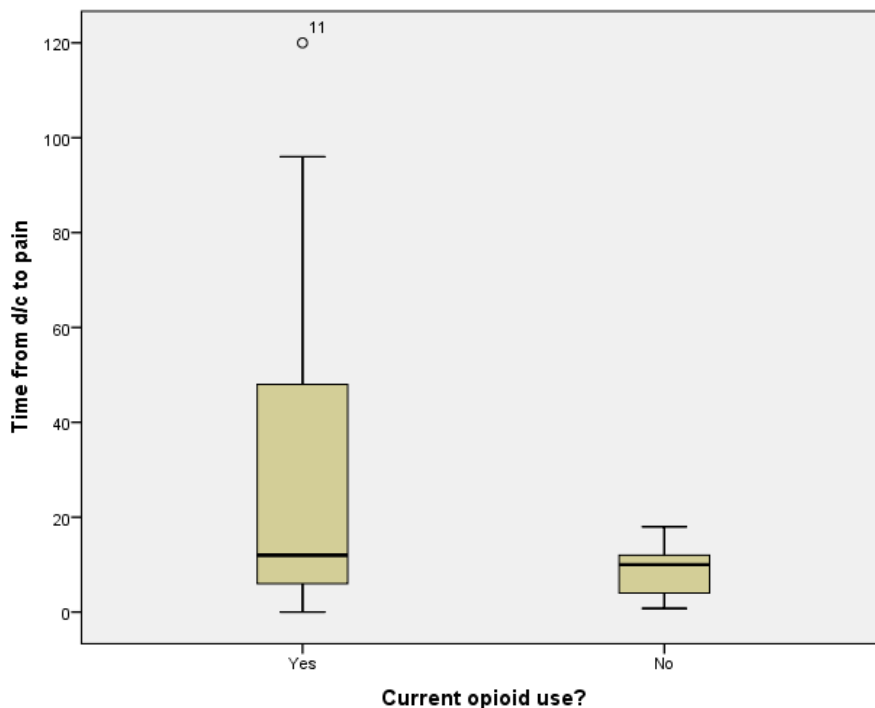


### Current Opioid Use

Subjects were asked whether they continued to require opioids to control pain. Eighty-two percent indicated that they did take opioids to control pain. Gender did not seem to be a factor for non-opioid users either for the five men or the four women. There was a slightly positive correlation (Pearson's  $r=0.171$ ) between current opioid use and the amount of time it took to be seen in the pain clinic. However, possibly because of the small sample size, there was no statistical significance. A larger sample size is needed to determine correlation significance (Cohen, 1988). The findings suggest that the longer it takes to be seen in a pain clinic, the more likely one is to be taking opioid medications for pain. Those currently requiring opioids were seen in a pain clinic at a median of 12 months while those not requiring them had a median of 18 months, not considering outliers. Only one of the current non-opioid users stated they would

have taken an offer to be treated in a pain clinic after surgery. Graph 7 demonstrates this relationship.

**Graph 7**



### Types of Pain Control Used

Respondents were questioned about the types of pain control they had used post-surgery discharge. The only patient that did not use opioids after discharge had no follow-up treatment even though pain had not improved since discharge. In addition, the subject reported a pain clinic referral would have been accepted. No data were collected about why modalities other than opioids were not used with subjects. Table 3 represents the frequency of types of pain control used by respondents. As indicated, opioids were used in all but one instance and other oral pain medications were often prescribed. Interventional therapies shown were used in a majority of the cases with the exception of muscle treatments which were only received by 10 of the subjects.

No information was gathered related to practitioner behaviors, but interventions, as shown in Table 3 may have occurred at any point in the treatment regimen.

### **Extraneous Factors**

Two additional questions were answered from chart reviews to determine whether they had co-morbidities associated with poor pain outcomes. These were whether the subjects were smokers and if they had any history of anxiety or depression.

When questioned whether they were smokers, roughly an equal number of subjects were smokers or non-smokers, 44% ( $n=22$ ) and 56% ( $n=23$ ), respectively. Using an independent samples t-test, equal variances were assumed;  $t(48)=0.321$ ,  $p>0.05$ . The results were not significant among smokers and non-smokers when comparing them to differences in pain scores (table 14). Thus, in this sample, smoking was not related to pain scores.

Equal variances were not assumed among those with or without a history of anxiety and/or depression. There was a significant difference in the scores for those with a history of anxiety/depression ( $M=-1.529$ ,  $SD=3.214$ ) and those without a history ( $M=.969$ ,  $SD=5.012$ );  $t(48)=-2.131$ ,  $p=0.022$ . This suggests that a history of anxiety and/or depression may have a negative effect on improvement in pain. Since this could be a confounding variable in the analysis of time from discharge to pain clinic and differences in pain scores, a partial correlation was conducted to control for history of anxiety and/or depression. The strength of the relationship continued to be significant with  $r=0.249$  and  $p=<0.05$  with time from discharge to the pain clinic associated with change in pain scores. Analysis of the zero order correlation ( $r=0.281$ ) suggest that a history of anxiety or depression has little effect on the strength of relationship of the mentioned variables.

## Discussion

Findings of this study indicate that there is a relationship between the amount of time it takes a patient to be seen in a pain clinic after discharge from a laminectomy surgery and the difference in the amount of pain the patient experiences. Pain scores either increase or decrease depending on time lapse prior to treatment. Findings also indicated the majority of the subjects would have accepted a referral to a pain clinic after discharge but only a few were afforded this option.

Johansen and colleagues (2012) found that post-surgical pain from specific locations such as lumbar laminectomies result in persistent pain in 40.4% of patients with 51% describing pain as chronic. Indeed, time is a factor in treatment because much of the pain may be attributed to sensory abnormalities, which are readily treatable in pain management clinics. Subjects in this study sought treatment to deal with this and other types of pain that resulted from surgery, but most were initially unaware they had the option of doing so immediately or soon after surgery. Facilitating a rapid follow up in a pain clinic could result in better pain outcomes for the post-laminectomy population.

Knowing what types of pain control were used (Table 3) is important because all of these methods are used within most pain clinics and significant healthcare costs could be saved by centralizing treatment. Gatchel, McGeary and McGeary (2014) indicated that this multidisciplinary approach to treating and preventing chronic pain in a pain treatment center is cost-effective and improves patient outcomes.

Hooten and colleagues (2009) reported that smoking had a significant negative impact on chronic pain patients and interestingly, Tsang and colleagues (2008) stated that common depression and anxiety are prevalent among this population. Flor, Fydrich and Turk (1992)

suggest this is important in that many chronic pain clinics should address these issues as part of a holistic approach to pain, using a multi-disciplinary approach that focuses on psychosocial aspects of pain, thereby possibly improving pain scores in the long-run.

### **Conclusions and Recommendations**

The purpose of this study was to determine which factors were relevant, after subjects had undergone a lumbar laminectomy surgery, in affecting pain scores. From this data it can be concluded there is a weak to moderate correlation between the level of pain and amount of time it takes from discharge after lumbar laminectomy surgery to time seen in a pain management clinic. The greater the amount of time it takes to be seen in a pain clinic, the worse pain can be. This study is limited by the small sample size and selection of subjects from only one pain center. Nonetheless, implications of findings are important.

### **Implications for Research**

Additional studies should include larger sample sizes from several different facilities and demographical locations to ensure a representative population. Additional questions about type of treatment could yield more detailed results as could further discussion about smoking, anxiety, depression and other factors that may affect pain scores and outcomes.

### **Implications for Practice**

Chronic pain is not often thought of as illness but rather a symptom of the disease process. However, treatment for chronic pain is carried out in such a manner that it is treated as an illness. From 2000 to 2008 the number of interventional techniques often used in pain management clinics nearly tripled (Manchikanti, et al. 2013). The American Association of Colleges of Nursing (AACN) position statement (2004) includes management of chronic illness

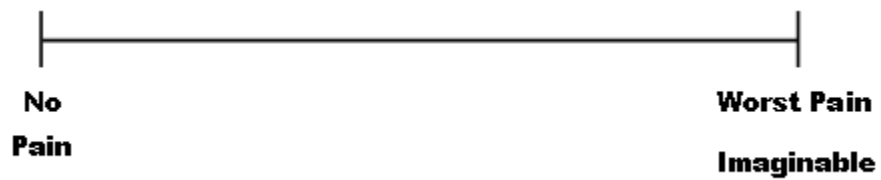
as one of area of nursing practice that is strong and that will be of benefit to populations of all ages in the future. The report also states that practice focused doctoral nursing providers will be essential in delivering care in this area. The research presented here is applicable to this type of practice and advanced practice nursing could have a great impact in the pain management arena.

### **Implications for Education**

The research conducted in this study utilizes essentials outlined by the AACN Essentials of Doctoral Education for Advanced Practice Nursing (2006). In particular, Essential I: Scientific Underpinnings for Practice has been met with the culmination of this research. Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes has been met as a multi-disciplinary team coordinated by an APN will be necessary to improve the pain scores for this population. Finally, Essential VIII: Advanced Nursing Practice epitomizes the spirit of this research. It will be necessary for an APN involved in this process to be able to utilize skills and techniques that are unique to advanced practice. Doctoral level advanced practice nursing will play an integral and effective role in improving pain management for post-laminectomy back pain patients.

## Appendix 1

### Visual Analog Scale (VAS) For Measuring Pain Levels



Note: The VAS must measure 10 cm, or 100 mm. The provider measures the mark on the line the patient makes and records it in mm on a scale of 0 to 100. The number is then converted to a 2 digit output with one decimal place. (Bijur, Silver & Gallagher, 2001)



## Appendix 2

### Chart Review and Questionnaire

#### Chart Review Data

Sex	Sex (Male, Female, Transgender)
Age	Age of participant in years.
Smoking Status	Smoker or Non-Smoker
History of Anxiety/Depression	Any history of either or both is yes, otherwise, no.

#### Participant Questionnaire

Opioids Used	Did you require opioids to control pain post-operatively? (yes or no)
Time to Pain Clinic	How long in days, weeks or months did it take to be seen in a pain clinic? (will be converted to months for measurement)
Current Opioid Use	Do you still require opioids for pain control? (yes or no)
Post-operative Treatment	Was pain treatment offered at discharge? (yes or no)
Post-operative Follow-Up	Where did you receive pain treatment the first time after discharge? (Surgeon's office, Primary Care Provider, Pain Clinic, Rehab Facility or None)  If you would have been offered follow-up pain care at a pain clinic would you have taken it? (yes or no)
Pain Status	Do you feel your pain was adequately controlled immediately after discharge? (yes or no)  Do you feel that your pain has consistently improved since discharge? (yes or no)
Pain Status (cont.)	What was your pain level at discharge? (VAS scale used)  What is your current level of pain? (VAS scale used)

## Pain Control Measures

What types of pain control measures have you used since discharge?

Opioid Medications? (i.e.: Percocet, Lortab, morphine) (yes or no)

Neruologics? (i.e.: gabapentin, Lyrica, Gabitril) (yes or no)

NSAIDs? (i.e.: meloxicam, ibuprofen, naproxen) (yes or no)

Muscle Relaxers? (i.e.: methocarbamol, cyclobenzaprine, tizanidine) (yes or no)

Other Meds? (i.e.: acetaminophen, tramadol, butalbital) (yes or no)

Physical Therapy? (yes or no)

Muscle Therapy? (i.e.: trigger point injections, TENS unit) (yes or no)

Spinal Injections? (i.e.: epidural steroids, facet injections) (yes or no)

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## Tables

**Table 1-Responses of Participants (N=50)**

Response	Were Post-Op Opioids Required?	Currently Use Opioids for Pain?	Offered Any Pain Tx at Discharge?	Would You have Taken a Pain Referral?	Was Your Pain Controlled at Discharge?	Has Your Pain Improved Since Discharge?	Are You a Smoker?	Do You have a History of Anxiety or Depression?
YES	96% (n=48)	82% (n=41)	38% (n=19)	90% (n=45)	52% (n=26)	32% (n=16)	44% (n=22)	68% (n=34)
NO	4% (n=2)	18% (n=9)	62% (n=31)	10% (n=5)	48% (n=24)	68% (n=34)	56% (n=28)	32% (n=16)

**Table 2- Locations of First Pain Treatment**

Location of First Pain Treatment	Surgeon's Office	Primary Care Provider	Pain Treatment Center	Rehabilitation Facility	None
<b>Number</b>	36% (n=18)	30% (n=15)	12% (n=6)	2% (n=1)	20% (n=10)
<b>Mean Time to Pain Center</b>	27.4 months	96 months	1.8 months	30 months	108 months

**Table 3-Interventions Used by Subjects**

Response:	N=50 Pharmacologic					Intervention		
	Opioids (Percocet, Lortab, etc.)	Neurologics (Gabapentin, pregabalin, etc.)	NSAIDs (Ibuprofen, meloxicam, etc.)	Muscle Relaxers (Cyclobenzaprine, tizanidine, etc.)	Other Pain Meds (Tylenol, tramadol)	Physical Therapy, Exercise, Meditation, ChoropRACTic, etc.	Muscle Treatment (Acupuncture, Trigger Point Injections)	Spinal Injections (Epidural, Facet Injections, Etc.)
YES	98% (n=49)	68% (n=34)	68% (n=34)	84% (n=42)	68% (n=34)	76% (n=38)	20% (n=10)	62% (n=31)
NO	2% (n=1)	32% (n=16)	32% (n=16)	16% (n=8)	32% (n=16)	24% (n=12)	80% (n=40)	38% (n=19)

### Capstone Report Conclusions

Evidence has shown that there is a weak to moderate correlation between the time a patient is discharged after having a lumbar laminectomy surgery to the time he or she is seen in a pain management clinic and a change in pain score. The correlation is positive suggesting that the longer it takes to be seen in such a clinic, the greater the pain based on scores reported. The statistical evidence is significant (Calhoun, Manuscript III, 2014). A majority of the patients included in the sample for this study were not offered follow-up pain treatment yet most reported they would have accepted referral for pain management had it been offered.

To bridge this gap and reduce pain in this population, it is suggested that a transitional model for interventions be implemented utilizing an advanced practice nurse (APN) for follow-up visits with the patient prior to discharge after a lumbar laminectomy surgery and throughout time in a pain management center where a multi-disciplinary team would begin treatment during the acute phase of pain with a goal of preventing the onset of chronic pain and overuse of opioid medications. Crofford (2010) recommends that monitoring and constant re-evaluation be put in place to prevent misuse. In addition, Naylor and colleagues (2011) have stated that transitional care elements are necessary and have a significant role in the Affordable Care Act and it may also address the related healthcare cost issue.

Dallas (2012) states that the cost of chronic pain in the United States is approximately \$635 billion per year with as much as 58% of this costs being related to orthopedic conditions such as lumbar laminectomy post-surgical pain. Prevention of the onset of chronic pain could help decrease this cost dramatically with the addition of the transitional element suggested. In addition, revenue could be generated to cover the costs of implementation by using APNs who



may bill for this service. Slater, et al. (2009) also concluded that early intervention in pain control issues lead to improved psychological outcomes and more rapid returns to work.

With the evidence at hand, it is incumbent upon APNs to work with other members of the health care team to develop a program that aids in this transition. A pilot program could be developed, with minimal cost, to measure and analyze outcomes for patients who have undergone lumbar laminectomy surgeries, ensure their pain is treated appropriately, and communicate efficiently with a multi-disciplinary team and present results at varying intervals. The ultimate goal would be to treat pain, administer appropriate medications which could include opioids, monitor medications, introduce various types of treatments and decrease or prevent chronic pain in this population.

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