THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF BIOBEHAVIORAL HEALTH

A STUDY OF THE EFFECTIVENESS OF OPIOID TREATMENT BETWEEN WORKERS' COMPENSATED PATIENTS AND NON-WORKERS' COMPENSATED PATIENTS WITH CHRONIC MUSCULOSKELETAL PAIN

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ABSTRACT

Throughout the past twenty years there has been a large emphasis on increased treatment for chronic, non-terminal illnesses. In the mid 1990s pain management physicians throughout the United States began increasing their rate of opioid prescriptions in an effort to meet this new pressure. In recent years, however, these doctors have been the subject of criticism for what many believe is a severe over prescription of opioids. These critics argue that long-term opioid treatment for chronic pain is ineffective and ultimately does more harm than good.

This study was performed with the assistance of a pain management clinic in upstate New York, and aimed to investigate the effectiveness of opioids as a long-term treatment for patients with chronic musculoskeletal pain. Subjects were comprised of 100 workers' compensated patients and 100 non-workers' compensated patients receiving opioid treatment. Opioid effectiveness was determined through the analysis of self-reported visual analog scale (VAS) scores of the subjects over six consecutive office visits. In addition to this, demographical information including age, gender, marital status, race, and drug screen statuses were analyzed. It was expected that overall the workers' compensated patients would show a smaller decrease than the non-workers' compensated patients in VAS scores over the six visits based on the fact that workers' compensated patients have a financial incentive to report higher levels of pain. It was also anticipated that the opioid treatments would not greatly improve the VAS scores of either group.

Although the experiment suggested a significant difference in change of VAS scores over the six visits between the two groups, there were inconsistencies when the reported scores were examined visit by visit. It was determined, though, that there was a significant association between gender, age, and drug screen status with workers' compensation status. Despite the fact

that workers' compensated patients showed a lesser decrease in VAS scores, overall neither group's decrease in VAS score was substantial.

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I would like to thank all of the people who were involved in making the completion of this project possible. Most notably, Dr. Frank Ahern, who guided me through the entire course of the study. His support, which ranged from fine-tuning a research question, to statistical advice and editing, was crucial to the success of the project. I would also like to thank Dr. Lori Frances for serving as the second reader for the project. Finally, I would like to thank The Center for Pain Relief pain management office for providing the data analyzed in this study.

Introduction

A History of Opioids

Opioids have been used to treat pain for thousands of years. Several modern pharmacologists theorize that Homer referenced opium in The Odyssey when he described a drug used by Telemachus and his friends.[1] Despite competing opinions on the presence of opiates in ancient writings, it is recognized with certainty that the Sumerians who occupied current day Iraq cultivated opium from poppy seeds for medicinal purposes. Records show that this took place around 3000 B.C.E. By the 1300s opiates had spread throughout the inhabited world and were used not only medicinally, but also recreationally.[1] During this time period opiate dependency and abuse became widespread, leading to the investigation of less addictive pain relievers. This initiated the manufacturing of drugs such as heroin and methadone, which ultimately failed at meeting the goal of serving as non-addictive pain relievers.[1] During the 19th century a consensus among doctors emerged that pain was necessary in order for healing to take place. This ideology greatly suppressed widespread use of painkillers throughout the 1800s.[2] During the 20th century; however, a shift began to occur. Morphine derivatives such as Oxycontin became more readily available and global use of painkillers began to rapidly increase yet again.[2] Despite the risks associated with opioids, their usage continues to grow, and in fact, they are the most prescribed category of drugs in United States today.[3]

Opioids are currently prescribed for a wide range of reasons. Traditionally they were used to treat pain following an operation or to ease a patient's suffering during a terminal illness. Recently, however, the use of opioids to treat chronic pain has become considerably more prevalent.[3] Perhaps the most significant reason for this change is due to social pressures that took

place in the 1990s, which called for a more focused treatment of patients with chronic pain. This impetus stemmed from what many considered to be an insufficient method for treating patients suffering from pain that could be neither eased with surgery nor with time. In turn, both the medical education system and the government placed a large pressure on physicians to change their approach to treating chronic pain patients.[3] This was followed by a restructuring of the pain management system in the United States, as traditional rehabilitation treatment quickly transformed into unprecedented levels of opioid treatment.[2] Many states enacted legislation backing this change in an attempt to provide chronic pain patients with a tangible solution to their health issues. In 2001, for example, California officials passed a law requiring all physicians (with the exception of radiologists and pathologists) to take a course in pain management.[2] This would enable them to be more qualified to prescribe opioids to their patients dealing with chronic pain. This also meant, though, that California physicians whose backgrounds were in something other than pain management could now treat patients with chronic pain.

This movement for increased opioid treatment has continued to grow, and today twenty-percent of all physician visits in the United States include some type of opioid prescription.[4] While most healthcare professionals agree that the prescription of opioids is appropriate post-operatively, for short-term use, and for patients nearing death, many feel that patients with chronic pain represent a gray area. Unlike most areas of medicine, the cause of chronic pain oftentimes does not show up on a scan or x-ray, making its treatment an imperfect science.[6] The vast majority of chronic pain patients suffer from musculoskeletal pain that can only be quantified through self-reports. This forces physicians to rely largely on the word of their patients, making a treatment plan more difficult.[6] Many patients who receive opioid treatment contend that it is better than no treatment, but ultimately their pain persists. A recent study showed that according to patient surveys, on average long term opioid treatment "takes the edge off the pain.[6]" The drugs have also been shown to be fairly ineffective for enabling disabled patients to return to

normal activities or work.[11] Many physicians and healthcare professionals agree that due to the clear risks of abuse and overdose associated with opioids, simply taking the edge off of pain does not justify the millions of prescriptions that are dispensed each year in the United States.[5]

There is also concern that the uncontrolled prescription of opioids greatly influences the illness behavior of patients.[6] The belief is that a person's perception of his own illness is subject to change. If a patient believes that narcotics are very serious, he or she may also believe that his or her musculoskeletal pain is more serious than initially thought. This is an especially relevant concern among healthcare professionals dealing with chronic pain patients because the majority of their pain is self-reported.[2] Therefore, any misrepresentation, subconscious or not, can result in an ineffective treatment plan. For this reason it is important for healthcare professionals to provide a setting where patients are most able to give honest and representative pain reports.

Another risk associated with long-term opioid use is what is known as the tolerance effect. As patients continue to take the drugs over the course of months and years they begin to require increasingly larger doses of the opioids to feel the same level of relief. This leads to the prevalence of more potent narcotics. Studies show that this phenomenon has given rise to the highest levels of illegal drug use and drug overdose that the United States has seen.[4]

Thomas Frieden, director of The Centers for Disease Control and Prevention (CDC) claims that the United States is currently facing "an epidemic of prescription drug overdose." In 2010, approximately fifteen thousand deaths resulted from opioid overdose. In addition to this, second to marijuana, opioids are the most commonly abused drug in the United States. [5] In an effort to combat these troubling statistics, physicians and lawmakers across the United States have begun to advocate for changes in policies regarding opioids, questioning whether the risks of long-term opioid use outweigh the benefits. According to Dr. Mitchell Katz, director of The Department of Health Services of Los Angeles, long-term opioid use is dangerous, and "until

there is more evidence, doctors should not continue to prescribe high-dose opioids for chronic non-cancer pain.[4]"

Opioids and Workers' Compensation

Workers' compensation was implemented by the United States in 1910. As the first extensive social insurance program organized by the government, it provided the framework for many of today's insurance programs in the United States.[7]

The state of New York defines workers' compensation as both a financial and medical insurance that protects workers who are injured as a direct result of their occupation.[8] In many cases, workers' compensation covers a wide range of rehabilitation services. The goal of these services is to facilitate the return of injured workers to their jobs.[8] Some claim that there are unintended consequences of worker's compensation and that often workers who receive these benefits ultimately never return to work.[11] In order for a workers' compensation claimant to receive compensation, he or she must seek care from a physician coded by the Workers' Compensation Board.[9] After the physician's approval through an independent medical examination, the patient is eligible to receive the benefits of workers' compensation. The physician can deem the patient's injury a complete or partial disability. If a person on workers' compensation is classified as completely disabled he or she will collect more compensation each month than a partially disabled worker, but unlike the partially disabled patient, the fully disabled patient is not permitted to work at all.[9]

Due to the fact that work related injuries are often musculoskeletal and difficult to definitively diagnose, physicians are frequently forced to make a difficult decision.[2] The fact that a physician's decision has an affect on the financial state of a patient, combined with the

subjectivity associated with self-reported pain scores has created a large controversy in the subject of workers' compensation. Although a physician hopes to reduce a patient's pain enough so that the patient is able to return to work, there exists the possibility that a patient would rather have just enough pain to stay out of work. After all, returning to work would mean losing the benefits of workers' compensation. In order to treat an injury, pain management physicians will commonly prescribe opioids. [2]

A study published by California's Workers' Compensation Institute (CWCI) shows that similar to the national trend, in recent years there has been a rapid and widespread increase in the number of opioid prescriptions to workers' compensated patients.[11] According to the State of Washington's Division of Industry and Labor there was a fifty-percent increase in the number of opioid prescriptions to workers' compensated patients from 1999-2007.[10] The CWCI's report also discusses two major theories. The first theory states that at high doses and over the long-term, opioid treatment can be a hindrance to self-efficacy and improvement. The second theory expresses that, in fact, long-term opioid use reduces the likelihood of a workers' compensated patient's return to work.[11] Although this method of prescribing opioids has become very controversial in recent years, it is especially pertinent to workers' compensated patients because of the larger implications of low efficacy in their situation. This study aimed to investigate a behavioral component of opioid use based on the widespread controversy regarding the effectiveness of long-term opioid use that has been published in recent years.

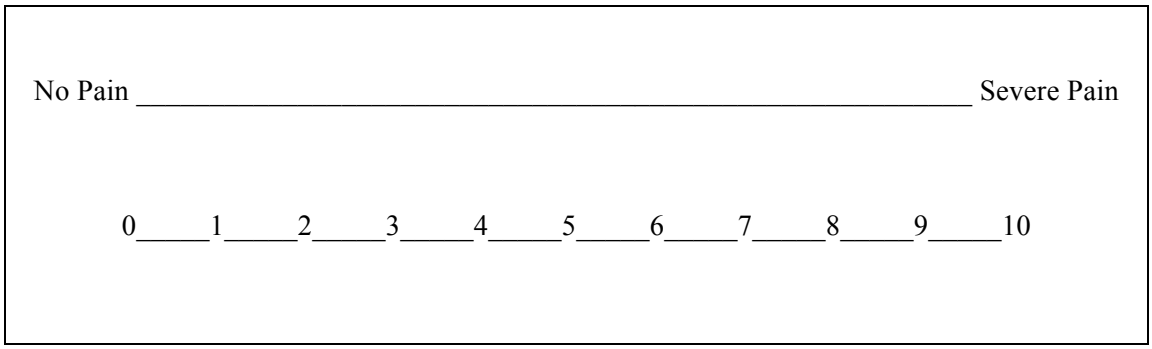
A Study of a Pain Management Clinic

In order to understand the complex controversy over the practice of prescribing opioids over the long-term to patients with chronic pain, it is important to examine the ways in which

patient pain and opioid efficacy can be defined. Given the difficulties in conclusively identifying the existence and cause of a chronic pain issue, there are limitations in the ways in which the issue can be treated. Although pain management physicians are specialized in reducing pain, oftentimes their ultimate goal is impossible to achieve.

One of the most well known methods for quantifying patient pain in clinics and hospitals throughout the United States is through the use of the visual analog scale (VAS). This scale allows patients to identify their level of pain at a given time over a continuum. A patient's VAS score can then be converted in to a raw number, or a numeric pain intensity number, which usually ranges from 1-10.[12] The two scales can be seen below in figure 1.

Figure 1. The Visual Analog and Numeric Pain Intensity Scales



This study aimed to analyze the effectiveness of opioids as a treatment for chronic pain between two groups—workers' compensated (WC) patients and non-workers' compensated (NWC) patients. The Center for Pain Relief (CPR), a pain management clinic in Vestal New York, provided data from its first 200 patients receiving opioid treatment for chronic pain in the year 2011. This was comprised of 100 WC patients and 100 NWC patients. It was determined that by observing the changes in VAS scores of these patients over six visits the effectiveness of long-term opioid treatment for chronic pain could be best determined. In order for the opioid treatment to be deemed effective, one would expect the average VAS score of the patients to decrease over the six visits.

Based on the regulations concerning workers' compensation, a patient must convince his or her physician that his or her pain is severe enough to be unable to work. Because much of what the physician relies on is the VAS score, a WC patient has an incentive to report a higher VAS score. By doing so, the patient's chances of maintaining workers' compensation insurance are increased. For this reason it was hypothesized that of the 200 patients observed, on average WC patients would report a higher VAS score than would NWC patients over the six visits. Although a physician's willingness to prescribe opioids to a patient may be somewhat dependent on the VAS score, NWC patients have no other clear incentive to exaggerate their pain scores.

In addition to this overarching question, additional patient variables were analyzed as potentially related to change in VAS score. These included age, gender, marital status, race, and drug screen results. Patients receiving opioid prescriptions from CPR are required to submit occasional urine samples in order to ensure that their prescribed opioid is present. These drug screens also check for any illegal or non-prescribed drugs in the patients' urine. If a patient's prescribed drug is not found in the urine screen, it is a potential sign of either drug abuse or drug sale. CPR will dismiss patients after two incidents where the prescribed opioid is not present in the urine screen or the urine screen shows the presence of illegal substances. Both WC and NWC patients risk losing access to opioids for a failed urine screen, but WC patients also risk losing their workers' compensated insurance. For this reason, it was hypothesized that there would be a higher rate of failed drug tests in WC patients than in NWC patients. It was also expected that there would be an association between drug test failure and marital status. It was anticipated that married patients would have a lower drug failure rate than unmarried patients. This was based on the notion that a married person may be more likely to make better lifestyle decisions. Finally, it was expected that there would be a higher number of male WC patients than female WC patients. This was based on the fact that there is a background higher rate of male workers' compensated injuries in New York State.[8] The main objective of this investigation was to examine whether

opioids would appear to be less effective for long-term treatment in WC patients than for NWC patients, as measured by the VAS score.

Methods

Source of Data

This investigation was made possible through a collaborative arrangement with The Center for Pain Relief (CPR), a pain management clinic in Vestal, New York. Vestal is part of the greater Binghamton area, which has a population of approximately 250,000.[14] Virtually every patient treated at CPR lives in the greater Binghamton area. The clinic population is broadly representative of the general population of the greater Binghamton area with respect to age, ethnicity, income, and insurance status. The physicians at CPR primarily treat patients with chronic back pain, prescribing opioids to approximately 75% of their patients. The office has a high frequency of both Medicaid covered, and workers' compensated patients.[15]

In order to test the hypotheses, a sample was drawn retrospectively of the first 100 WC patients and the first 100 NWC patients coming to the clinic in calendar year 2011. Additional criteria for inclusion in the sample included: 1) each patient was required to have a record of at least six subsequent office visits in the year 2011; and 2) each patient had to be prescribed some type of opioid at each of these visits. It was estimated that 200 patients (100 WC and 100 NWC) would be sufficient to not only study the relationship of self reported pain between WC and NWC patients, but to also examine the effect of age, gender, race, marital status, and drug screen results on VAS scores over the six clinic visits.

Methodology

The Office for Research Protections at The Pennsylvania State University reviewed the procedures for this study. Since the study planned to use secondary de-identified data provided by the CPR staff, the Institutional Review Board gave the study "Exempted Status" (Appendix A). Appendix B provides the form the CPR staff used to record data for this study. The data provided included patients' workers' compensation status, gender, age, race, marital status, drug screen results, opioid name and dose, visit number (1-6), VAS score at each visit, and the number of days between each visit. Patient ages were categorized by ten-year intervals. Patients were assigned a sequential identification number (1-200) by the CPR staff in order to link them to their chart.

Table 1, below, gives a description of the abbreviations used in the results section of this study.

Table 1. Abbreviations Used in This Study

Name	Abbreviation
Workers'-Compensated	**WC**
Non-Workers' Compensated	**NWC**
Visual Analog Scale	**VAS**

Statistical Analyses

Descriptive statistics were calculated in order to show the frequency distributions of the different variables. These included gender, age, race, and marital status. The frequencies of these independent variables were shown in terms of WC and NWC (Table 2).

In order to examine the major hypothesis of change in VAS scores between NWC and WC patients, it was determined that an Analysis of Covariance (ANCOVA) mixed model would be most appropriate. As a preliminary step chi-square analyses were performed in order to evaluate the statistical significance of potential covariates with compensation status. These included: compensation status vs. gender, compensation status vs. race, compensation status vs. age range, compensation status vs. marital status, and compensation status vs. failed drug screen rate. In addition to this, a chi-square analysis was performed in order to examine the relationship between failed drug screen rate and marital status. Relationships that were approaching statistical significance ($p < 0.1$) were included in the ANCOVA model. Relationships that were not approaching statistical significance were excluded from the ANCOVA model.

An ANCOVA model was selected to analyze the relationship between compensation status and VAS score. This procedure also evaluates the interaction terms between compensation status and the significant indicators. Finally, ratios of VAS score from the first and last visits were calculated in order to examine long-term VAS score change.

Results

Descriptive Statistics

The final sample (N=200) consisted of WC (N=100) and NWC (N=100). Table 2 provides a breakdown of the demographic variables according to workers compensation status. Males comprised 46.5% of the sample (N=93) and females made up 53.5% (N=107). The ages of the patients in the final sample ranged from 25 to 84 ($\bar{X}$ =51.14, SD=13.18). Caucasian patients comprised 61.5% of the final sample (N=123), non-Caucasian patients made up 6% (N=12), and 32.5% of patient charts did not specify a specific race (N=65). For those patients whose charts reported marital status (missing 7%; N =14) 53.0% were married (N=106), 12.5% were divorced (N=25), and 27.5% were single (N=55).

Table 2. Number and Percent of Patients by Demographic Factors and Workers Compensation Status

Variable	NWC (N = 100)		WC (N = 100)	
	N	%	N	%
Gender				
Male	38	40.1	55	59.1
Female	62	57.9	45	42.1
Race				
Caucasian	62	50.4	61	49.6
Other	5	41.7	7	58.3
Missing	33	60.0	32	40.0
Age				
20-29	4	50.0	4	50.0
30-39	18	56.3	14	43.7
40-49	19	38.0	31	62.0
50-59	22	34.9	41	65.1
60+	37	78.7	10	21.3
Marital Status				
Married	54	50.9	52	49.1
Single	29	52.7	26	47.3
Divorced	9	36.0	16	64.0
Missing	8	57.1	6	42.9

Table 3 provides the frequency of failed drug screens according to compensation status and marital status.

Table 3. Drug Screen by Compensation Status and Marital Status

Variable	Passed Screen		Failed Screen	
	n	%	*n*	%
Comp status				
NWC	56	56.0	44	44.0
WC	70	70.0	30	30.0
Marital Status				
Married	71	67.0	35	33.0
Single	30	54.5	25	55.5
Divorced	19	76.0	6	24.0
NA	6	42.9	8	57.1

Of NWC patients 44% failed a drug screen (N=44). Of WC patients, 30% failed a drug screen (N=30). Drug screens showed that 33.0% married patients failed a drug screen (N=35), 55.5% of single patients failed a drug screen (N=25), 24.0% of divorced patients failed a drug screen (N=6), and 57.1% of patients who did not specify a marital status failed a drug screen (N=8).

Analytical Statistics

The association between compensation status and demographic factors was evaluated by Chi-square analyses. Table 4 provides the results of this analysis.

Table 4. Analysis of the Association of Compensation Status and Selected Demographic Indicators and Drug Screen

Variable	Value	df	Significance
Patient Gender	5.808[a]	1	.016
Age Range	24.621[a]	4	.001
Race	.357[a]	2	.837
Marital Status	2.447[a]	3	.485
Failed Drug Screen	4.204[a]	1	.040

There is a significant association between compensation status and patient gender (X^2 = 5.8, $p < .016$). Based on the frequency distribution shown in table 2, it is evident that males are more likely than females to be on workers' compensation. There is also a statistically significant association between compensation status and patient's age ($X^2 = 24.6$, $p < .001$). Further examination of this association shows that patients over the age of 65 are least likely be on workers' compensation (Table 2). No statistically significant associations were observed between compensations status and race or marital status. However, the analyses did show a statistically significant association between workers' compensation status and failing the drug screen (X^2 = 4.2, $p = .04$). WC patients were more likely to fail a drug screen than NWC patients (Table 3).

The primary hypothesis for this study centers on whether workers compensation status is related to change in VAS scores over the six visits. Table 5 shows the mean and standard deviation of the VAS scores for WC and NWC patients at each of the six visits.

Table 5. Average VAS Score Over Six Visits by Workers Compensation Status

(each visit; WC N=100, NWC N=100)

	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6
WC						
$\bar{X}$	6.54	6.81	6.32	6.72	6.67	6.78
SD	2.09	1.91	2.08	1.83	1.90	1.83
NWC						
$\bar{X}$	6.92	6.80	6.45	6.58	6.68	6.42
SD	1.89	2.02	3.10	2.03	2.04	1.75

Analysis of Covariance (ANCOVA) was used to examine the association of workers compensation status to VAS score change. Only variables for which there was a significant association with workers compensation status (Table 4) were included in the model. The results of this analysis are shown in Table 6.

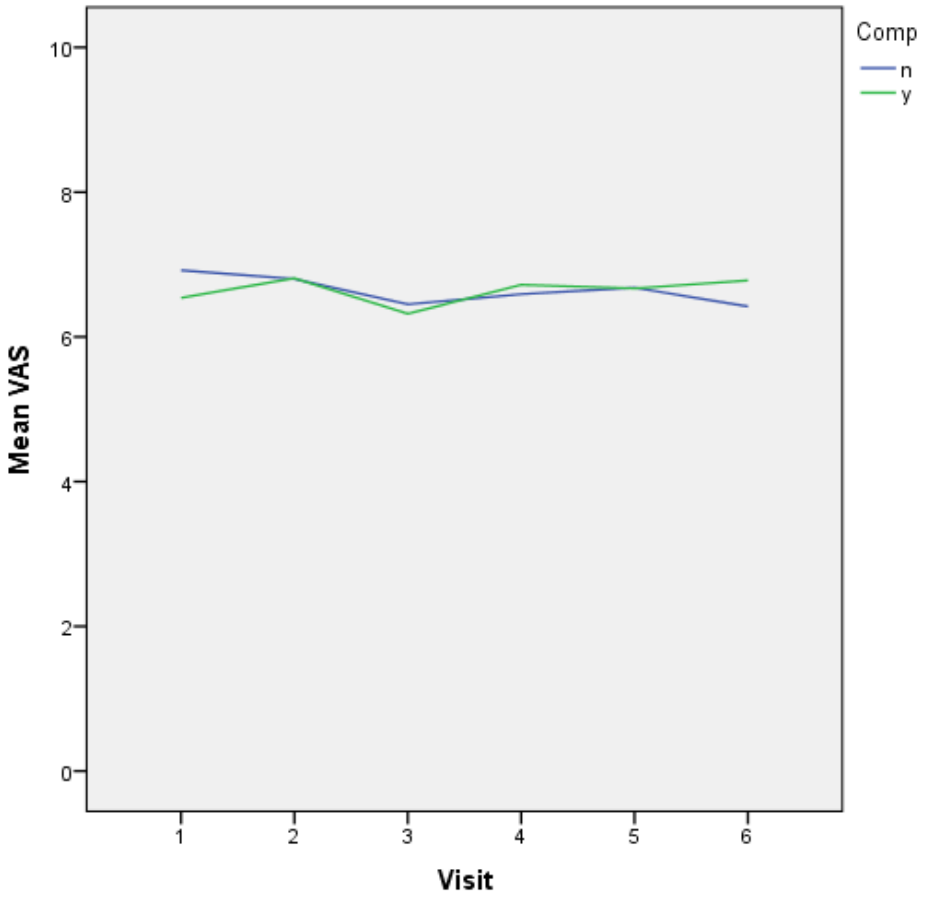
Table 6. Analysis of Covariance (ANCOVA) of VAS Scores

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower	Upper
Intercept	7.05	.49	207.25	14.36	0.00	6.09	8.02
Non-Comp	.38	.29	426.00	1.34	-.18	- .18	.95
Gender (Female)	.03	.28	437.07	.100	.92	-. 52	.58
Passed Drug Screen	-.40	.29	428.42	-1.37	.17	- .97	.17
Age	-.01	.01	199.97	-.65	.51	-.02	.01
Visit	.06	05	376.45	1.21	.23	-.04	.17
Non-Comp x Visit	-.11	.05	376.45	-2.30	.02	-.21	- .01
Gender (Female) x Visit	.03	.05	376.45	-.69	.49	-.13	.06
Drug Screen Failure x Visit	-.02	.05	376.45	-.37	.71	-.11	.08

The results shown in table 6 indicate that none of the main effects for workers compensation, gender, failing a drug screen, age, or visit were significantly associated with VAS scores. There was however a significant interaction between workers compensation status and visit ($p = .022$).

Examination of the average VAS scores in Table 5 does not show a simple explanation of the interaction effect. In order to better discern the nature of the interaction, the mean scores for the six visits for both the WC and NWC groups are presented graphically in Figure 2.

Figure 2. Mean VAS Score over Six Visits for Comp vs. Non-Comp



Discussion

This investigation aimed to examine the effectiveness of opioids as a long-term treatment for a specific group of patients. Based on the collective analysis of patient subgroups, it becomes increasingly easier to determine the efficacy of drugs such as opioids. While many long-term opioid users suffer from musculoskeletal pain, those who both take opioids and receive workers' compensation, represent a unique category.

The primary hypothesis that WC patients would have a lesser decrease in VAS score over time as compared to NWC patients was partially supported (Tables 5, 6 and Figure 2) but the results were inconsistent. This lack of consistent results across the multiple visits suggests that other factors may be operating to produce variability in VAS scores and by implication, the effectiveness of opioid treatment. While the variation in effectiveness may be due to some characteristic of being on workers' compensation, the observed variation also illustrates the potential subjectivity that exists in self-reported pain scores. It may be that the difference in change of VAS scores over time between the two groups is due to the motivation that WC patients have to report a higher VAS score. In contrast to this, one might argue that WC patients might have more debilitating pain than NWC patients, which might be more difficult to treat. While there is not strong evidence supporting WC patients having greater pain, it might have occurred in this particular sample and may be the basis for the statistically significant change in VAS scores between the two groups observed in this study. If WC patients begin with a higher VAS score they would have a greater range over which a decrease in VAS score could occur. Despite the support the results lend toward the main hypothesis, this study points to the presence of subjectivity in reports of VAS scores.

As mentioned in the introduction, it was expected that males would represent the largest portion of patients on workers compensation. This is because there is a higher prevalence of males than females on workers' compensation in New York.[8] In terms of age, table 4 shows that

the relationship between age and compensation status was statistically significant. Again, as shown in table 2, it is evident that this is due to the large number of patients over the age of 65, who are not on workers' compensation. This is perhaps expected because by definition workers' compensation applies to working age people and although many elderly continue to work, many persons over age 65 are in fact retired.

The association between compensation status and race was not statistically significant, which may have been due to the small number of non-Caucasian subjects. Similarly, marital status is not associated with compensation status. This means that compensation is not biased to a particular marital status, but rather evenly distributed among single and married patients.

The drug screen analyses showed that NWC patients were more likely than WC patients to fail a drug screen. This was expected based on the fact that WC patients risk losing their workers' compensation for a failed drug screen. Although both groups risk losing their opioid prescriptions, only the WC patients have a monetary risk associated with a failed drug screen. It is unlikely that NWC patients possess unique behavioral characteristics that make them more likely to fail a drug screen, but rather, the risk of losing compensation seems to be enough of an incentive to significantly suppress this urge in the WC group. It would be interesting to investigate the causes of drug screen failures in the two groups in future experimentation. This could explain whether there is a correlation between high VAS scores and high rate of opioid abuse.

The drug screen analysis supported the hypothesis that married patients are least likely to fail a drug test (tables 3, 4). This may be due to a correlation between marriage and the selection of positive lifestyle choices. On the other hand, it may be that persons who are likely to use illegal drugs are less likely to be marriage candidates.

Table 5 shows the average VAS scores of WC and NWC patients over the six office visits. These averages provide some evidence that VAS scores do not decrease substantially over

time with use of opioid treatment. It is possible to examine the ratios of VAS scores between adjacent visits and over the span of the total six visits. One might expect that an effective treatment would lower a patient's VAS score by the sixth visit. A ratio of visit 1:visit 6 that is larger than 1 shows that the patient's average pain has decreased over time, while a ratio below 1 shows an increase in pain. In the case of WC patients, the average VAS score was higher at visit 6 than at visit 1. This ratio, which was equal to .96, shows a very slight increase in pain level over time. The same ratio for NWC patients was determined to be 1.08. This shows a slight improvement in pain for NWC patients over time. Despite these small changes in reported pain levels, the proximity of the ratio values to 1 supports the notion that opioid treatment over six visits was not significantly effective for either group.

In summary, this investigation did not strongly support the main hypothesis that over time there is a smaller decrease in VAS scores among WC patients than NWC patients. The VAS scores of patients between visits showed irregular patterns (Figure 2). The three sub-hypotheses, were supported by the investigation—WC patients are less likely than NWC patients to fail a drug screen, married patients are less likely than non-married patients to fail a drug screen, and long-term opioid treatment is not a very effective treatment for either WC or NWC patients. The investigation included 200 subjects, which was sufficient to test the main hypothesis, although it may have limited the possibility of examining indicators such as race. In addition to this, the study defined six visits as the length of time to track patient VAS scores. On average this is six months, which might have been an insufficient length of time for analysis of long-term opioid treatment as chronic pain patients oftentimes use opioids over the span many years. There was also variation in the time between each visit of the subjects. If these differences were not evenly spread, for example time between each visit of WC patients could be less than NWC patients, the VAS scores could be skewed. Finally, the study was confined to a small geographic region, which may be subject to various factors that are not representative of the national cohort of chronic pain

patients. For future research on this subject, it would be useful to survey pain management offices from around the entire country and over a longer period of time.

Despite the limitations of this investigation, the results of this study do shed light on the controversy over long-term prescription of opioids. The variability of results support the notion that long-term opioid treatments are not very uniformly effective. However, it may be that there are significant differences in opioid effectiveness among subgroups of chronic pain patients. In order to resolve this growing controversy, it is essential to examine the issue comprehensively. The relative impact of opioid treatment on WC vs. NWC patients might be expected to be more salient if larger and more representative samples could have been drawn from multiple pain clinics in a variety of settings. Although much research has been done on the subject of opioid treatment with chronic pain patients, there is a lack of research that focuses on the detailed demographic factors of opioid users. It is unlikely that the debate on long-term opioid use will end anytime soon, although as more research is done, this practice appears to be increasingly ineffective.

Appendix A

Office of Research Protections (ORP) Approval

From: **Stephanie Krout**
Subject: IRB Protocol ID# 41784, "A comparison of the effectiveness of opioid treatment in workers' compensated patients versus non-workers' compensated patients"
Date: December 12, 2012 8:54:43 AM EST
To: Jake Kammerman
Cc: Frank Ahern

Hide

Inbox - email.psu.edu

Jacob Kammerman,

The Office for Research Protections (ORP) has received and reviewed the above referenced eSubmission application. It has been determined that your research is exempt from IRB initial and ongoing review, as currently described in the application. You may begin your research. Your study's Exemption Determination letter has been uploaded into PRAMS.

To access your letter:

- Log into PRAMS (http://www.prams.psu.edu)
- In the blue, left-hand menu, expand the "Human" link (click on the +)
- Click on "Protocol Folder Active"
- Select your "Protocol ID" (IRB number)
- Select the "Documents" tab
- The letter is located in the "Approval Letter" folder

If a funding source requires a signature on the Exemption Determination letter, please do not hesitate to contact me. The above-referenced IRB # MUST be included in any correspondence sent to this office regarding this study.

Thank you,

Stephanie L. Krout
Research Compliance Coordinator
The Pennsylvania State University | Office for Research Protections | The 330 Building, Suite 205 | University Park, PA 16802
Direct Line: (814) 865-2935 | Main Line: (814) 865-1775 | Fax: (814) 863-8699 | www.research.psu.edu/orp

Appendix B

Patient Information Sheet

Patient Chart Information

Chart Number:

Workers Comp: Y N

Employment Status

Gender:

Age:

Race:

Marital Status:

Medication/dose:

Visit	1	2	3	4	5	6
Days since last visit						
VAS						

Additional Notes:

Failed drug test Y N

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ACADEMIC VITA

Jacob S. Kammerman

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Education

B.S., General Science, Minor in Spanish, 2013, Pennsylvania State University, University Park, Pennsylvania.

Honors and Awards

Accepted to early assurance program at Penn State's College of Medicine at Hershey. Anticipated start date of August 2014.

Association Memberships/Activities

Phi Beta Lambda, professional business fraternity (2011-present)
- Professional development, philanthropy, and case competition events

Scholars for Sharing the Journey International (2011-present)
- Co-founder of Penn State student medical service group
- Support aid to Guatemalan children with cleft palates

THON—Pediatric Cancer Research Fundraiser (2010-present)
- Largest student-run philanthropy in the world
- Involved in year-round efforts to raise funds

SHOTIME mentor—Schreyer Honors orientation (summer 2011)
- Help freshman become oriented at Penn State and in the Honors College
- Mentor younger students within my major

GLOBE Special Living Option (2011-2012)
- Honors housing for global awareness initiative
- Promote cultural awareness on campus

Professional and Travel Experience

United States Embassy, Lima, Peru (summer 2012)
- Foreign Commercial Service intern

- Performed market research on the medical equipment industry
- Organized events and materials promoting trade between the US and Peru

AL George, Binghamton, NY (summer 2010)
- Quality control & audit
- Surveyed displays and condition of convenience stores

Travel Experience
- Biology 499A: Coastal field ecology trip to Costa Rica
- Theater 496: Theater course in London
- Hiram Bingham Exchange: High school exchange with Lima, Peru, International School
- Other countries visited: Egypt, Thailand, Israel, Turkey, Mexico, Brazil, Italy, Greece

Research Experience

General and Organic Chemistry Labs
- Familiar with micropipetting, titrations, spectroscopy, chromatography (TLC, liquid, gas), distillation, purification, crystallization

General Biology Lab
- Familiar with PCR, gel electrophoresis, microscopy, cell counting and staining