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# Pain as the Subjective Fifth Vital Sign Among Patients Undergoing Knee or Hip Arthroplasty

Lindsey Sukay

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Pain as the Subjective Fifth Vital Sign Among Patients  
Undergoing Knee or Hip Arthroplasty

A Thesis Submitted to the  
Yale University School of Medicine  
in Partial Fulfillment of the Requirements for the  
Degree of Doctor of Medicine

by  
Lindsey Christine Sukay  
2006

ADDRESSING PAIN AS THE SUBJECTIVE FIFTH VITAL SIGN AMONG  
PATIENTS UNDERGOING KNEE OR HIP ARTHROPLASTY.

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The purpose of this study was, among patients undergoing knee or hip arthroplasty, to examine patients’ expectations for and experiences of postoperative pain, their perceptions of the quality of their pain management, and to identify potential barriers to effective pain management. This was a prospective cohort study of 68 patients undergoing knee or hip arthroplasty at Yale-New Haven Hospital. Patients were interviewed within 48 hours after surgery using a modified version of the American Pain Society Satisfaction Survey and were asked the amount of pain they expected to have postoperatively (EP) and the actual pain that they experienced in the previous 24 hours (AP) using the Numerical Rating Scale (NRS). Patients were asked a series of questions regarding their attitudes toward pain management (PM). Their rating of the quality of PM was measured in two ways: a) how satisfied they are with their physicians’ management of their pain, and b) how well their goals for PM have been achieved.

Patients were 59% female and 82% white. Most patients experienced moderate to severe pain following surgery, with a mean worst pain of  $8.2 \pm 2.7$  on the 11-point NRS. Patients expected to experience significantly more pain following surgery (mean  $7.3 \pm 2.4$ ) than they actually experienced (mean  $5.1 \pm 2.5$ ) (EP-AP=2.3,  $p < .001$ , signed rank test). Forty percent of patients in the study believed that pain is a necessary part of the healing process, 36% were concerned about addiction, and 22% believed that health care

providers are annoyed by discussions about pain. Patients whose goals for PM were met reported a greater difference between the pain they expected and the pain they actually experienced following surgery (EP-AP=2.8) than those whose goals were not met (EP-AP=0.9,  $p=.02$ ). Fifty percent of patients who reported a pain score  $>5$  felt that their goal for PM was very well or well met, and 70% of patients who reported a pain score  $>5$  were very satisfied or satisfied with their PM. Patients who were concerned about building tolerance to their pain medication were significantly more likely to report that their goals for PM were met despite high pain scores, (47%) than were patients without this concern (16%,  $p=.02$ ). Patients who were concerned about building tolerance were also more likely to report high satisfaction despite high pain scores) (53%) than patients without this concern (22%,  $p=.03$ ), and they were also more likely to be significantly concerned about addiction (48% vs. 19%,  $p=.02$ ).

A substantial number of patients are satisfied with their PM and feel that their goal for PM is met despite experiencing moderate to severe pain following surgery. We identified several possible reasons for this discrepancy, including patient concerns about tolerance and addiction. Patients give high ratings of quality of PM if their pain is severe, as long as the pain is not as severe as they expected. This suggests that patients give high ratings of quality, in part, for the wrong reasons. The study also demonstrated that substantial numbers of patients endorse beliefs that may be barriers to effective pain management.

## **Acknowledgements**

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## **Introduction**

### **Pain as a Persistent Problem in the Postoperative Setting**

#### *Prevalence of Postoperative Pain*

The American Pain Society defines pain as an “unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (1). Postoperative pain is greatest following thoracic, abdominal, head and neck, and orthopedic surgery (2). As early as 1973, studies revealed that more than 70% of patients with acute pain reported moderate to severe levels of pain, regardless of the pain medications that they were prescribed (3). Another study found that of 500 randomly interviewed patients, 77% reported having pain following surgery (4). More recent studies have shown that up to 80% of patients experience moderate to severe levels of pain following surgery despite receiving some type of analgesia. Postoperative pain is experienced by both inpatients and outpatients (5). One recent study found that 40% of patients undergoing ambulatory surgery experience moderate to severe pain in the first 24 hours following discharge from the hospital (6). Another study found the prevalence of moderate to severe pain in ambulatory patients as high as 25% (7).

The percentage of patients reporting moderate to severe postoperative pain has not improved over the past 40 years, despite the development of new medications and sophisticated drug delivery systems. These medications have proven efficacy, and the new delivery systems are proven to deliver the medications more effectively than traditional routes of administration. Both the new medications and delivery systems are widely in use.

### *Pain Following Knee or Hip Arthroplasty*

In the United States, approximately 43.9 million surgeries are performed annually. Total knee and hip arthroplasties represent 418,000 and 220,000 of these surgeries respectively (8). Arthroplasty patients typically experience moderate to severe levels of postoperative pain, with knee replacement patients experiencing higher levels of postoperative pain than hip replacement patients and having higher opioid requirements throughout their hospital stay (9, 10).

### *Guidelines for Management of Acute Pain*

In the 1990s, several sets of guidelines were published to address the undermanagement of acute pain. In 1991, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) published guidelines to support routine assessment and documentation of pain in terminally ill patients (11). In 1992, the Agency for Health Care Policy and Research (AHCPR), U.S. Department of Health and Human Services, issued guidelines, “Acute Pain Management: Operative or Medical Procedures and Trauma, Clinical Practice Guideline.” This document highlighted the undermanagement of pain and delineated how unrelieved postoperative pain increases recovery time, raises health care costs, and significantly increases patient discomfort. It emphasized the need to educate patients of the importance of informing their caretakers if they had unrelieved pain. It also promoted the aggressive treatment of acute pain by caretakers (12).

The American Pain Society’s Quality of Care Committee published a set of guidelines in 1995, “Quality Improvement Guidelines for the Treatment of Acute Pain and Cancer Pain.” These guidelines included five essential elements: 1) to recognize and



treat pain promptly, 2) to make information about analgesics readily available, 3) to promise patients attentive analgesic care, 4) to define explicit policies for use of advanced pain control techniques, and 5) to evaluate the process and outcomes of pain management with the goal of constant improvement. The American Pain Society (APS) also developed the Patient Outcome Questionnaire, which assesses outcome by asking questions about pain intensity, patient satisfaction, and factors influencing satisfaction (13).

The American Society of Anesthesiologists (ASA) published “Practice Guidelines for Acute Pain Management,” also in 1995, which specifically addressed the management of pain in the perioperative setting. The ASA guidelines were the first to emphasize the importance of a multimodal analgesic approach to pain management. They also promoted patient controlled analgesia (PCA), epidural analgesia, and the standardization of procedures between institutions. The ASA recommended that proactive planning for pain management become part of each institution’s plan of care for each patient (14).

In 2001, JCAHO revised its pain management standards to require the assessment, monitoring, and treatment of pain as a condition of accreditation. The JCAHO guidelines emphasize three key areas: pain assessment, patient, physician and nurse education, and quality assurance programs. They identify pain as the “fifth vital sign,” dictating that throughout a patient’s hospitalization their pain will not only be routinely addressed, but treated (5, 15).

In July 2005, the prevalence of moderate to severe postoperative pain was noted to be as high as it was 40 years ago. In response, the American Pain Society revised their

Recommendations for Improving the Quality of Acute and Cancer Pain Management.

The new guidelines specify that all hospitals should formulate multilevel system approaches that are specific to the type of pain, population served, and setting of care.

They emphasize the rapid recognition and management of pain, with regular reassessment and adjustment of the treatment plan as needed, and recommend regular recording of the outcomes of pain management. The guidelines call for pain management to move beyond assessment and communication of pain to improvements in management that employ multimodal approaches that are safe and evidence-based (16).

### **Measurement and Assessment of Postoperative Pain**

#### *Measurement versus Assessment*

Measuring and assessing pain are two distinct processes. To measure is to “ascertain the quantity, mass, extent, or degree of in terms of a standard unit or fixed amount usually by means of an instrument or container marked off in units.” To assess, however, is to “analyze critically and judge definitively the nature, significance, status, or merit” (17). This distinction is important in the evaluation of pain because pain is a complex, subjective phenomenon that cannot be solely quantified, but must be approached from a multidimensional perspective. It is commonly accepted that assessment is the first step in any pain management strategy and that pain measurement is necessary to compare approaches and gauge progress in management (18).

Current guidelines for the management of acute pain call for the regular assessment and treatment of pain and pain is now described as the fifth vital sign. Pain is a complex phenomenon, and when patients report pain, they are reporting much more

than the intensity. Pain intensity has however been demonstrated to be the most important contributor to the experience of pain due to its effect on quality of life and functioning (18). Pain is a subjective experience, and patients' self-reports provide the most valid measurement of their pain (19). Pain is what the patient says it is (20). When patients use pain rating scales, we assume they are conveying their entire experience of pain as well as their response to our management of it. There are four main unidimensional rating scales used in clinical practice: the Visual Analogue Scale (VAS), the Verbal Rating Scale (VRS), the Numerical Rating Scale (NRS), and the Faces Pain Scale. Each of these scales is a valid, reliable measure of pain intensity. Multidimensional pain tools, such as the McGill Pain Questionnaire and the Brief Pain Inventory, are also valid measures of pain.

#### *Unidimensional Pain Rating Scales*

The VAS is a 10-cm line with verbal descriptors at each end of the line. Typically these descriptors are "no pain" at one end and "worst pain imaginable" at the opposite end. Patients are asked to indicate their pain intensity by making a mark on the VAS line, and scores are determined by making a measurement from the marker for "no pain" to the patient's own mark. Measurements are made in millimeters, giving 101 possible scores for pain intensity. When studied with the VRS, scores of about 30mm on the VAS correspond to moderate pain, and a score of 54mm or more is equivalent with severe pain (21). Studies have shown that in order for the VAS to be accurate, it must be used in the orientation according to the reading pattern of the population in which it is used. A study of the VAS in Chinese patients showed less error with the vertical

orientation, while VAS in English speakers has a significantly lower error rate when oriented horizontally. The disadvantage to this scale is that it must always be presented on paper or electronically, and photocopying of the scale significantly changes its length over time. When this scale is repeated in a short time period, it has high test-retest reliability, although the reliability is decreased in cognitively impaired patients. These patients are less likely to report pain and are not as capable of using the VAS (21). The VAS has high sensitivity, as a very slight change in pain intensity can be detected by the scale.

The VRS is composed of a list of phrases that describe increasing levels of pain. Most commonly, the phrases used are “no pain; mild pain; moderate pain; and severe pain.” Each of the phrases is assigned a number, 1-4, for recording purposes. The VRS was recently validated in a study that used sound as the variable stimulus. This scale has the lowest sensitivity of the three scales, as typically only four descriptors for pain intensity exist. A much greater change in pain intensity, therefore, is needed in order to recognize change on the scale. A 1994 study attempted to use a VRS with 15 phrases to describe pain. In this study, four phrases accounted for 78% of patients’ choices. Although it is possible that the patients did not understand the remaining answer choices, it is likely that they were satisfied with only four to six descriptors for their pain (22). Studies that have attempted to quantify the VRS on a numerical scale have found that patients describe mild pain as between 1 to 4 on an 11-point scale, moderate pain between 5 and 6, and severe pain by 7 and above (23).

The NRS is also graded from no pain at one end to the worst pain at the other end, with 11, 21, or 101 points in between. Typically this scale is presented to the patient

verbally, with 11 options (“Rate your pain on a scale from 0 to 10, with 0 being no pain and 10 being the worst pain imaginable.”). If the scale is presented in written form, the numbers are written horizontally with “no pain” above the 0 and “worst pain” above the highest number. This scale is not as reproducible as the other two, although it also has not been investigated as thoroughly (23). The NRS has fairly high sensitivity. A 1994 study demonstrated that this scale is more effective in assessing pain when the 11 or 21 point scales are used, as the 101 point scale discriminates more points than most patients require. When assessing their pain on the 101 point scale, most patients actually categorize in multiples of 5 or 10, and 75% of the patients used the 101 point scale as though it was the 11 point scale (24).

A pain scale employing faces was originally developed for use in children. After many adaptations to control for cultural and age-related bias, the current Faces Pain Scale was developed in 1990 by Bieri et al. (25). The scale measures pain using a range of faces from “no pain” (a neutral face) through six other faces showing increasing levels of discomfort to the “worst pain” face. The faces are oval-shaped, adult in appearance, and are not clearly male or female. They are displayed in a horizontal format, and patients are instructed to point to the face that best reflects the amount of pain they are experiencing. This scale has high test-retest reliability and a high degree of validity.

The correlation between these four pain rating scales has been studied. A 2003 study found a strong agreement between the VAS and NRS scales ( $r = 0.94$ ) (25). A correlation in postoperative pain scores was also demonstrated between the NRS and VAS by DeLoach et al. However, the regression line slopes in this study suggested that the scales do not agree, and therefore a direct conversion cannot be made between the

two (26). The VRS and VAS have only a slight correlation when studied between patients, and the correlation is only good at lower pain intensities. At higher pain levels the association between the two scales decreases greatly (27). The Faces Pain Scale has a strong positive correlation with the VAS, VRS and NRS, with the strongest correlation being with the NRS (28).

Studies have shown that in order for any of the scales to be used accurately to describe current pain, patients must have access to their pain score history (29, 30). However, if the patient's opinion of pain, not objective experience, is desired, it is more accurate to present the scales without score histories. The "failure rate" (defined by an incomprehensible or incomplete response by the patient) of the pain rating scales is between 4% and 11% for VAS and between 2% and 0% for NRS and VRS respectively (31, 32). The failure rate of the VAS can be reduced with extensive teaching (21).

Many patients prefer the VRS and NRS because they are easy to understand and use. The VRS in particular is preferred by older patients and children because it does not require the abstract thinking that the VAS demands and instead uses broad categories. Patients with more sophisticated abstract thinking ability prefer the VAS because it is by far the most sensitive indicator of changes in pain. In clinical practice, the NRS is the most widely used scale. It is easy to administer and is equally sensitive as the VAS. The VAS is the most difficult scale to use, as it requires paper or electronic administration and significant teaching time. It also has the highest failure rate, limiting its usefulness in clinical practice. The VRS, although the least sensitive, is easy to administer and is also widely used (21).

### *Multidimensional Pain Assessment Tools*

Multidimensional tools assess two or more dimensions of the experience of pain simultaneously, either with the same tool or with combined tools. These tools are typically not used to assess pain in the acute setting. The two most widely used multidimensional instrument, the Brief Pain Inventory (BPI) and the McGill Pain Questionnaire (MPQ) are typically used to assess cancer pain and chronic non-cancer pain, respectively. These tools have both been validated in many cross-cultural and multilingual protocols. The BPI measures cancer pain intensity and its interference with activities of living and psychological function. The MPQ is a complex tool that takes 5-10 minutes to administer. The questionnaire is composed of lists of descriptors that fall into four main groups: sensory, affective, evaluative, and miscellaneous. Patients are given instructions to choose only words that describe their feelings and sensory experience at that moment. The results are grouped into three indices that can then be interpreted (19). The MPQ also exists in a short form, which contains 15 descriptors (11 sensory, 4 affective) (33). The BPI, MPQ and short MPQ are all proven as consistent, reliable, and valid methods of assessing pain.

### **Patient Expectations of Pain**

#### *Expectations of Postsurgical Pain*

In a 2002 article on the importance of patient expectations in total joint arthroplasty, Mahomed et al define patient expectation as “anticipation that given events are likely to occur during or as a result of medical care. This is in contrast to patient

desires, which reflect the patient's wishes that a given event occur" (34). Studies have shown that the majority of patients expect to experience pain following surgery (29, 35) but also expect to receive analgesics (36). Patients do not expect that their pain will be completely alleviated, even with medications, and most patients do not have a goal of total pain relief. In fact, most patients have low expectations for pain relief following surgery (37).

#### *Expected Pain and Actual Pain Experienced*

Studies have provided contradictory data on the relationship between the pain that patients expect to experience following surgery and the pain that they actually experience. A 1997 study by Carr et al showed that although patients expect pain following surgery, they experienced significantly more pain than they expected (38). Nay et al found that, for patients undergoing coronary artery bypass grafting, patients actually expected more pain over a longer time period than they experienced following surgery (39). A more recent study of 200 patients undergoing elective orthopedic and open abdominal surgeries also showed that patients may expect more pain than they actually experience. In that study group, 91% of patients expected to experience moderate to severe pain, while only 9% expected no pain or only mild pain. The actual pain experienced by patients in this study was lower than what they expected; 76% experienced moderate to severe pain, while 25% had no pain or only mild pain. Patients who expect to experience more pain may report higher levels of pain than patients who do not have expectations of severe pain (40).



A study by Wallace examined the predictive relationship of patient expectations of postoperative pain and the actual experience of pain and distress following surgery. Wallace examined three hypotheses. The first was that patients who expect to have pain will report higher postoperative pain levels than patients who do not expect to have pain (that is, pain expectation and experience are positively related). The second hypothesis postulated that the greater the difference between expected and actual pain, the greater the distress postoperatively. The third hypothesis stated that the direction of the difference was the important factor, such that patients who expect postoperative pain to be greater than it actually is will have less distress. Wallace found partial support for all 3 hypotheses, showing that patients who expected pain had higher pain intensity after surgery and that the greater the difference between the expected and actual pain, the greater the distress postoperatively. Patients who expected more pain than they actually experienced had less distress in the postoperative period. Further analysis on the second and third hypothesis did not find support for either one (41).

### **Discordance between Pain Intensity and Satisfaction**

Several studies have examined the relationship between postoperative pain and patient satisfaction. Despite the fact that most patients experience moderate to severe pain following surgery, the majority of patients report that they are satisfied with their postoperative pain management (37, 42-45). A small number of studies have aimed to identify the factors that could explain this discrepancy. One study found that patients' perceived control over their pain and pain medication mediated the relationship between pain severity and patient satisfaction (46). Another found the discrepancy may be

explained by patients' expectations of the pattern of pain relief; if patients expect a peak and trough pattern of pain relief, they may be satisfied even if they experience high levels of pain (47). A 1983 study by Donovan et al. showed that 86% of patients were satisfied with their pain relief postoperatively. Of the patients who were satisfied with their pain relief, 25% reported moderate, severe, or unbearable unalleviated pain. When patients were asked why they were satisfied with their pain relief despite having significant pain, 75% reported that they were satisfied because they expected pain following surgery. Fifty-two percent of the group reported satisfaction because the pain was less than expected and 34% because the pain was less than they had experienced before. Additional reasons for satisfaction despite significant pain included not wanting to upset the nurse (7%), knowing that the pain would improve (50%) and knowing why the pain was present (26%). This study demonstrated that patients may be satisfied because most of them expect pain following surgery and that the expectation for pain relief is not high (43).

A 2003 study examined how the American Pain Society Satisfaction survey items related to actual satisfaction. This study found a weak relationship ( $r = -0.24$ ) between pain intensity and patient satisfaction. It also showed that satisfaction was influenced instead by medication effectiveness, independent of pain intensity, and by communication (42). Other studies that assessed satisfaction independently of pain intensity suggest that it is influenced by variables such as patient knowledge about the surgery, perceived concern of the healthcare team, and patient expectations of pain following surgery (48).

### **Gaps in Current Knowledge**

There are contradictory reports in the literature on the relationship between the pain that patients expect to experience and the pain that they actually experience. Further research is needed to understand patient expectations of pain and to determine how the pain that patients expect compares to the pain that they actually experience. Many authors anecdotally support the “expect the worst and it will be better” theory as an important component of patient satisfaction with pain management following surgery (45). However, studies that empirically test this theory are needed to determine how patient expectations influence their ratings of the quality of their pain management. Although we are aware of a number of subjective factors that may influence patient satisfaction with pain management, there are no studies of attitudes and beliefs of surgical patients concerning pain or pain management. It is clear from previous research that discordance exists between the high pain intensity scores reported by patients and their high levels of satisfaction with their pain management. At this time, we are unaware of the factors that account for this discordance.

## **Purpose**

The purpose of this study is, among patients who have undergone knee or hip arthroplasty, to examine patients' expectations for and experiences of postoperative pain, their perceptions of the quality of their pain management, and to identify potential barriers to effective pain management.

## **Hypotheses**

We hypothesize

1. Patients experience high levels of pain following knee or hip arthroplasty. Most patients who undergo arthroplasty are satisfied with their pain management.
2. Substantial numbers of patients endorse beliefs that are potential barriers to pain management, including beliefs that pain is a necessary part of the healing process, that "good patients" should not complain about pain, and patient concern that healthcare providers are annoyed by discussions about pain.
3. Factors associated with ratings of the quality of pain management, measured in terms of patient satisfaction and meeting goals for pain management, include preoperative physician discussion about pain, the experience of side effects, and patient expectations of pain.
4. A discordant relationship exists between postoperative pain intensity and patient ratings of the quality of pain management, with patients reporting high ratings of quality despite reporting high pain scores.

5. The attitudes and beliefs endorsed by patients account for the expected discordance between postoperative pain intensity and patient ratings of the quality of pain management.

### **Aims**

The aims of this study are

1. To describe the intensity of pain experienced by patients, as well as their ratings of meeting goals for pain management and satisfaction with pain management.
2. To identify the prevalence of potential barriers to adequate postoperative pain management.
3. To identify the factors associated with meeting goals for pain management and satisfaction with pain management.
4. To examine the frequency with which patients have discordance between their reports of postoperative pain intensity and meeting goals for pain management and between postoperative pain intensity and satisfaction with pain management.
5. To determine whether the identified barriers to adequate pain management account for the discordance between pain intensity and the quality of pain management.

## **Methods**

### *Participants*

The study protocol was approved by the Yale School of Medicine Human Investigations Committee. All patients provided written informed consent prior to their participation in the study. Patients were eligible for participation if they had undergone partial knee, total knee, bilateral partial or total knee, partial hip, total hip, or bilateral partial or total hip arthroplasty at Yale- New Haven Hospital in the preceding 48 hours. Patients were excluded from the study if they were less than 18 years old, were not English-speaking, had a diagnosis of dementia, or if there was documentation in the medical record that they were presently deemed incompetent to make their own medical decisions.

### *Data Collection*

Data was collected intermittently from June 2003 through April 2005. Patients were identified as eligible for participation in the study by a single member of the nursing staff on the orthopedic unit of Yale-New Haven Hospital. After identifying an eligible patient, she approached the patient and asked if they would be interested in participating in a one to two-hour interview as part of a study on patient experiences with pain following knee or hip replacement surgery. Patients were interviewed using a survey instrument that contained 91 items and took approximately 1-2 hours per participant to administer. The interviews were conducted within 48 hours postoperatively in the patients' rooms on the orthopedic unit of Yale-New Haven Hospital. The survey was computer-based and was constructed using a Microsoft Access-based program. The

interviewer read each question aloud to the participant and responses were entered directly into the computer immediately after each response was given.

### *Measures*

There were four main outcome measures in the study: patients' expectations regarding their pain, the intensity of pain experienced by patients following surgery, patients' ratings of the quality of pain management, and patients' attitudes and beliefs about pain management. To assess patient expectations of pain following surgery they were asked, "On a scale from 0-10, with 0 being no pain and 10 being the worst pain, what was the average amount of pain that you expected to experience following surgery?" For questions throughout the survey that asked patients to rate their pain on a scale from 0-10, patients were shown a large-scale visual aid. The visual aid consisted of a horizontally oriented, 20 inch ruler, with the numbers 0 through 10 spaced 2 inches apart along the length of the ruler. Patients were asked to point to their answer choice on the scale, and their responses were immediately entered into the computer by the interviewer.

Pain intensity at various points in time following surgery was assessed by 4 different survey items. Patients were asked: a) On a scale from 0-10, with 0 being no pain and 10 being the worst pain possible, what is the average amount of pain that you have experienced in the past 24 hours? b) On a scale from 0-10, how much pain did you have immediately upon waking from surgery? c) On a scale from 0-10, how much pain are you having right now? and d) On a scale from 0-10, what is the worst pain that you have had since your surgery?

The third measure of the study assessed patient satisfaction and patients' assessment of meeting goals for pain management. Satisfaction was assessed by requesting patients to "Select the phrase which indicates how satisfied you are with the way your doctors managed your pain (very satisfied, slightly satisfied, slightly dissatisfied, very dissatisfied). To assess how well patients' goals for pain management were achieved, patients were asked, "How well do you feel that your goal for pain management has been achieved (very well, well, fair, poor, or not at all)?"

We studied several attitudes and beliefs that we believed might account for the discrepancy between pain intensity and satisfaction. These included survey items that asked patients to strongly agree, agree, disagree or strongly disagree with statements a) I am hesitant to report to my doctors or nurses when I have pain because "good patients" should not complain about pain b) Healthcare professionals such as doctors and nurses find it annoying to talk about pain and c) I am hesitant to report pain to my doctors or nurses because having pain means that something must be going wrong. Patients were also asked if they were very concerned, slightly concerned, slightly unconcerned, or very unconcerned about building tolerance to pain medication, becoming addicted to medication that they were described for pain, or about developing side effects from pain medication. The attitudes and beliefs that we chose to study were adapted from prior studies in patients with cancer.

There were multiple survey items that addressed patient demographics. We included descriptive variables on age, sex, race, marital and financial status, and educational level. The type of surgery that the patient had undergone was recorded, as was their surgical history and other medical comorbidities.



### *Data Analysis*

The data from the surveys was analyzed by John O’Leary, Data Manager and Analyst at the West Haven VA Medical Center and by my faculty advisor, Dr. Terri Fried, an Associate Professor in the Department of Internal Medicine, according to an analysis plan developed by myself with the assistance of Dr. Fried.

We used univariate statistics to describe the study population. Univariate statistics were also performed to describe the pain intensity levels reported by patients at various points following surgery and to describe their expected pain. We utilized the signed rank test to determine whether the difference between the pain that patients expected to experience following surgery and the pain that they actually experienced was significantly different from 0. We also used univariate statistics to describe the agreement with attitudes and beliefs that we identified as potential barriers to good pain management and to describe satisfaction with pain management and meeting goals for pain management.

We dichotomized satisfaction with pain management into high and low satisfaction, with high satisfaction being a response of very satisfied or satisfied, and low satisfaction a response of slightly dissatisfied or very dissatisfied. We dichotomized meeting pain goals into well met and not well met, with well met being a response of “very well” or “well” met, and not well met being a response of “fair”, “poor”, or “not at all”. We then examined factors associated with pain goals being well met and high satisfaction, using t-tests for continuous variables and chi-square tests for categorical variables.

Patients were identified as being either concordant or discordant in their ratings of pain intensity and whether their pain goals were met. Discordant patients were those who felt that their goals for pain management had been very well or well met but who reported an average pain intensity score of  $> 5$  over the previous 24 hours. Concordant patients were those whose goals were very well or well met and who had an average pain intensity score of  $\leq 5$  over the preceding 24 hours and those whose goals were met fairly, poorly, or not at all but who had average pain scores  $>5$ . Patients were also identified as being either concordant or discordant in their ratings of pain intensity and their satisfaction with pain management. Discordant patients were very satisfied or satisfied with their pain management but reported average pain scores of  $>5$  over the previous 24 hours. Concordant patients were very satisfied or satisfied and had average pain intensity scores  $\leq 5$  over the preceding 24 hours or were slightly dissatisfied or very dissatisfied but had average pain scores of  $>5$ . We then examined the factors associated with discordance, using t-tests for continuous variables and chi-square tests for categorical variables.

## **Results**

### *Study Population*

The study population (n=68) was 59% female and 41% male (Table 1). The mean population age was  $65 \pm 13.1$ . Eight-one percent were white, while 10% were black, 1.5% were Latino, and 8.8% identified themselves as having a different ethnicity. Fifty-three percent of the study population was married and 52% had greater than a high school education, while 11% had less than 12 years of education and 35% reported a high school education. Forty-five percent of patients in the study had undergone total unilateral knee replacement as their most recent surgery, while 4.4% underwent partial knee replacement, 5.9% bilateral total knee replacement, 35.2% total hip replacement, and 8.8% partial hip replacement. Thirty-one percent had undergone a previous joint replacement surgery. Participants had a range of comorbidities that would be expected in an older patient population (Table 2).

Table 1: Demographic Description of the Study Population (n=68)

Characteristic		Number	Percent
<b>Gender</b>	Male	28	41.1
	Female	40	58.8
<b>Age</b>	Mean (SD)	65 (13.1)	
	Minimum	23.0	
	Maximum	91.0	
<b>Ethnicity</b>	White	55	80.9
	Black	7	10.3
	Latino	1	1.5
	Other	6	8.8
<b>Marital Status</b>	Married	36	53.0
	Divorced/Separated		
	Widowed		
	Never married		
<b>Income</b>	Not enough	3	4.4
	Just enough	15	22.1
	Some left over	47	69.1
<b>Level of Education</b>	Did not complete high school	7	11.0
	High school	24	35.0
	College or graduate degree	36	52.0

Table 2: Surgical History and Medical Comorbidities of the Study Population

Event	Frequency	Percent	Cumulative Frequency	Cumulative Percent
<b>Present Surgery</b>				
Partial Knee Replacement	3	4.4	3	4.4
Total Unilateral Knee Replacement	31	45.6	34	50.0
Bilateral Total Knee Replacement	4	5.9	38	55.9
Partial Hip Replacement	24	35.3	68	100.0
<b>Previous Joint Replacement</b>				
Yes	21	30.9	21	30.9
No	47	69.1	68	100.0
<b>Coronary Artery Bypass Grafting</b>				
Yes	3	4.4	3	4.4
No	65	95.6	68	100.0
<b>Hernia Repair</b>				
Yes	8	11.8	8	11.8
No	60	88.2	68	100.0
<b>Cholecystectomy</b>				
Yes	11	16.2	11	16.2
No	57	83.8	68	100.0
<b>Removal of Renal Stone</b>				
Yes	2	2.9	2	2.9
No	66	97.1	68	100.0
<b>Tonsillectomy</b>				
Yes	30	44.1	30	44.1
No	38	55.9	68	100.0

Table 2 (cont.): Surgical History and Medical Comorbidities of the Study Population

<b>Coronary Artery Disease</b>					
Yes	4	5.9	4	5.9	
No	64	94.1	68	100.0	
<b>Congestive Heart Failure</b>					
Yes	1	1.5	1	1.5	
No	67	98.5	68	100.0	
<b>Chronic Obstructive Pulmonary Disease</b>					
Yes	3	4.4	3	4.4	
No	65	95.6	68	100.0	
<b>Chronic Renal Disease</b>					
No	68	100.0	68	100.0	
<b>Hypertension</b>					
Yes	31	45.6	31	45.6	
No	37	54.4	68	100.0	
<b>Diabetes Mellitus</b>					
No	68	100.0	68	100.0	
<b>Cancer</b>					
Yes	13	19.1	13	19.1	
No	55	80.89	68	100.0	

### *Pain Intensity Following Arthroplasty*

Most patients experienced moderate to severe pain following surgery (Table 3). The mean worst pain experienced by patients in this study following surgery was  $8.2 \pm 2.7$  on the Numerical Ratings Scale. In the 24 hours following surgery, the average pain level reported by patients in the study was  $5.1 \pm 2.5$ . The mean pain that patients

expected to have following surgery was  $7.3 \pm 2.4$ . Patients therefore expected to experience significantly more pain following surgery (EP) than they actually experienced (AP)(mean of the intra-individual differences calculated as  $EP-AP=2.3 \pm 3.1$ ,  $p<.001$ , signed rank test).

Table 3: Pain Intensity Ratings on 11-Point Numerical Rating Scale (NRS)

Rating of Pain Intensity on NRS	Mean $\pm$ SD
<b>Average pain in past 24 hours</b>	$5.1 \pm 2.5$
<b>Pain upon waking from surgery</b>	$4.0 \pm 4.3$
<b>Pain at time of interview</b>	$3.3 \pm 2.4$
<b>Worst pain since surgery</b>	$8.2 \pm 2.7$
<b>Expectation of average pain prior to surgery</b>	$7.3 \pm 2.4$
<b>Difference between expected and actual pain in last 24 hours</b>	$2.3 \pm 3.1$

#### *Ratings of the Quality of Pain Management*

Ten percent of patients did not respond to the survey items on meeting goals for pain management. Of those who provided a response, 35% felt that their goal for pain management had been achieved very well, and 25% felt that it had been achieved well. Twenty percent gave a rating of fair, while 4.4% stated that their goal was met poorly, and an additional 4.4% stated that their goal for pain management was not met at all (Table 4). Twelve percent of patients did not respond to the survey item on satisfaction

with pain management. Of those who did respond, 69% of patients were very satisfied with their physician's management of their pain, while 13% were slightly satisfied. Four percent of patients were slightly dissatisfied with their pain management, while 1.5% was very dissatisfied.

Table 4: Patients' Assessment of Quality of Pain Management

Ratings of Quality of Pain Management	Number	Percent
<b>How well goal for pain management was met</b>		
Very well	24	35.3
Well	17	25.0
Fair	14	20.6
Poor	3	4.4
Not at all	3	4.4
Did not respond	7	10.3
<i>Total</i>	68	100
<b>How satisfied with physician's management of pain</b>		
Very satisfied	47	69.1
Slightly satisfied	9	13.2
Slightly dissatisfied	3	4.4
Very dissatisfied	1	1.5
Did not respond	8	11.8
<i>Total</i>	68	100

#### *Patient Attitudes and Beliefs*

Patients in the study endorsed several attitudes and beliefs about pain management (Tables 5 and 6). For each of the survey items that addressed patient attitudes and beliefs about pain, approximately 15% of the study population did not provide a response. Of



those who did respond, 40% agreed or strongly agreed with the statement that pain is a necessary part of the healing process. Twenty-two percent of patients agreed or strongly agreed with the statement that health care providers find it annoying to talk about pain. When asked how concerned are they were about developing side effects from their pain medications, 41% of patients responded that they were very concerned or somewhat concerned. When asked how concerned they were about becoming addicted to the medications prescribed for pain, 36% of patients in the study responded that they were very concerned or somewhat concerned about addiction.

There were several attitudes and beliefs that were not endorsed by patients in the study. Seventy-six percent of patients disagreed or strongly disagreed with the statement that they were hesitant to report pain to their doctors or nurses because having pain meant that their prosthesis was not working properly. Most patients disagreed or strongly disagreed with the statement that “good patients” should not complain about pain.

Table 5: Patient Attitudes and Beliefs about Pain

Statement	Patient Responses (%)				
	Strongly agree	Agree	Disagree	Strongly disagree	Did not respond
<b>Pain is a necessary part of the healing process</b>	22	18	6	40	14
<b>“Good patients” should not complain about pain</b>	1	4	6	74	15
<b>Doctors and nurses find it annoying to talk about pain</b>	4	18	16	46	22
<b>I am hesitant to report pain because having pain means something must be wrong</b>	4	4	1	75	16
<b>If my pain is completely eliminated, my doctor will stop working to make me better</b>	4	4	1	75	16

Table 6: Patient Concerns about Pain Medications

Question	Patient responses (%)				
	Very Concerned	Slightly Concerned	Slightly Unconcerned	Very Unconcerned	Did not respond
<b>How concerned are you about building tolerance to pain medication?</b>	7	19	4	46	24
<b>How concerned are you about side effects from pain medications?</b>	29	12	16	24	19
<b>How concerned are you about becoming addicted to pain medications?</b>	24	12	10	43	11

#### *Factors Associated with Meeting Pain Goals*

There were several factors associated with meeting goals for pain management (Tables 7a and 7b). Patients who felt that their pain goals were well met had significantly less pain immediately upon waking from surgery (2.7 vs. 6.6 on NRS,  $p < .001$ ) and less average pain in the 24 hours prior to the interview (4.3 vs. 6.5,  $p < .001$ ) than patients whose goals for pain management were not met. Those whose goals were met also had a greater difference between the pain they expected to experience and the pain they actually experienced following surgery compared to those whose goals were not well met (2.8 vs. .09,  $p = .02$ ). Patients whose goals were very well or well met were less likely to report that their sleep had been disturbed by pain. Those whose goals were very well or

well met were also less likely to report long waiting times after requesting medications. We identified a trend in patients who reported having discussions with their physician about surgery or pain management being more likely to report that their goals for pain management were well met.

Table 7a: Pain Intensities Associated with Meeting Goals for Pain Management

Factor	Pain Goal Very Well or Well Met (N=41)	Pain Goal Not Well Met (N=20)	
	Mean value on NRS		p-value
<b>Average pain in last 24 hours</b>	4.3	6.5	<.001
<b>Pain upon waking from surgery</b>	2.7	6.6	<.001
<b>Pain at time of interview</b>	2.9	3.7	.23
<b>Worst pain since surgery</b>	7.6	9.1	.04
<b>Expected pain</b>	7.1	7.4	.67
<b>Difference between expected and actual pain</b>	2.8	.09	.02

Table 7b: Factors Associated with Meeting Goals for Pain Management

Factor	Pain Goal Very Well or Well Met Percent	Pain Goal Not Well Met	p value
<b>Amount of time elapsed until pain relief provided</b>			
No pain medication needed, or <15 minutes	74	26	.02
>15 minutes	36	64	
<b>Episodes of nausea or vomiting</b>			
0	65	35	.64
1 or more	70	30	
<b>How often pain interfered with sleep</b>			
Never	84	16	.002 (test for trend)
1-20% of the time	67	33	
21-70% of the time	45	55	
>70% of the time	33	67	
<b>Patient had previously taken pain medication</b>			
Yes	68	32	.72
No	60	40	
<b>Physician discussed severity of pain to expect prior to surgery</b>			
Yes	59	41	.17
No	75	24	
<b>Physician discussed prior to surgery how postoperative pain would be treated</b>			
Yes	73	27	.16
No	55	45	

*Factors Associated with Satisfaction with Pain Management*

Actual pain experienced following surgery was not associated with patient reports of satisfaction with pain management (Tables 8a and 8b). However, there was a trend toward patients with a greater EP-AP difference reporting higher levels of satisfaction with their pain management. Patients who were satisfied with their pain management were less likely to report that their sleep had been disturbed by pain. While 67% of patients who reported have one or more episodes of nausea or vomiting following surgery were very satisfied with their pain management, 88% of patients who had no nausea or vomiting were very satisfied ( $p=.05$ ). Physician discussion about pain was not associated with satisfaction with pain management.

Table 8a: Pain Intensities Associated with Being Very Satisfied with Pain Management

Factor	Very Satisfied (N=47)	Less than Very Satisfied (N=13)	p-value
	Mean value on NRS		
<b>Average pain in last 24 hours</b>	4.8	5.8	<.19
<b>Pain upon waking from surgery</b>	3.8	4.2	.76
<b>Pain at time of interview</b>	2.9	3.5	.42
<b>Worst pain since surgery</b>	7.9	9.0	.16
<b>Average Expected pain</b>	7.4	6.7	.37
<b>Difference between Average expected and actual pain</b>	2.6	.08	.07

Table 8b: Factors Associated with Being Very Satisfied with Pain Management

Factor	Very Satisfied Percent	Less than Very Satisfied	p value
<b>Amount of time elapsed until pain relief provided</b>			
No pain medication needed, or <15 minutes	81	19	.27
>15 minutes	67	33	
<b>Episodes of nausea or vomiting</b>			
0	88	12	.05
1 or more	67	33	
<b>How often pain interfered with sleep</b>			
Never	91	9	.03 (test for trend)
1-20% of the time	70	30	
21-70% of the time	60	40	
>70% of the time	57	43	
<b>Patient had previously taken pain medication</b>			
Yes	79	21	.34
No	60	40	
<b>Physician discussed severity of pain to expect prior to surgery</b>			
Yes	82	18	.34
No	72	28	
<b>Physician discussed prior to surgery how postoperative pain would be treated</b>			
Yes	77	23	.97
No	76	24	



*Discordance between Meeting Goals, Patient Satisfaction, and Pain Intensity Scores*

Discordance between ratings of pain intensity and quality of pain management was frequent. Seventy percent of patients who reported a pain score of  $>5$  reported being satisfied with their pain management, and 50% of patients who reported a pain score  $>5$  felt that their goal for pain management had been met. We identified several factors associated with discordance (Tables 9 and 10). Patients who were concerned about building tolerance to their pain medication were significantly more likely to report that their pain goals were met despite high pain scores (47%) than were patients without this concern (16%,  $p=.02$ ). Patients who were concerned about building tolerance were also more likely to have high satisfaction despite high pain scores (53%) than patients without this concern (22%,  $p=.03$ ). Those who were concerned about becoming addicted to their pain medications were more likely to have high satisfaction despite high pain scores (48%) than those who were not concerned about addiction (19%,  $p=.02$ ).

Table 9: Factors Associated with Meeting Goals for Pain Management Despite High Pain Scores

Factor	Discordant Group (N=13)	Percent	Concordant Group (N=40)	p-value
<b>Concerned about Addiction</b>				
Yes	35		65	.13
No	17		83	
<b>Concerned about Side Effects</b>				
Yes	35		65	.20
No	18		82	
<b>Concerned about Tolerance</b>				
Yes	47		53	.02
No	16		84	
<b>Belief that pain is a necessary part of having surgery</b>				
Yes	33		67	.20
No	18		82	
<b>Belief that doctors and nurses find it annoying to talk about pain</b>				
Yes	30		70	.26
No	14		86	

Table 10: Factors Associated with High Satisfaction with Pain Management Despite High Pain Scores

Factor	Discordant Group (N=16)	Percent	Concordant Group (N=34)	p-value
<b>Concerned about Addiction</b>				
Yes	48		52	.02
No	19		81	
<b>Concerned about Side Effects</b>				
Yes	37		63	.41
No	26		74	
<b>Concerned about Tolerance</b>				
Yes	53		47	.03
No	22		78	
<b>Belief that pain is a necessary part of having surgery</b>				
Yes	32		68	.84
No	35		65	
<b>Belief that doctors and nurses find it annoying to talk about pain</b>				
Yes	18		82	.21
No	39		61	

## Discussion

Among a small sample of post-operative patients who had undergone knee or hip replacement, levels of postoperative pain were high. Patients who underwent these surgeries expected to experience more pain than they actually had. Most patients in the study were satisfied with their pain management and felt that their goals for pain management had been achieved. Substantial numbers of patients in the study believed that pain is a necessary part of the healing process and many felt that healthcare professionals are annoyed by discussions about pain. Meeting goals for pain management was associated with less pain upon waking from surgery, less average pain following surgery, and a greater difference between expected and experienced pain. Patients were more likely to report that their goals for pain management were met and that they were satisfied with their pain management if pain did not interfere with their sleep. Many patients give high ratings of quality of pain management despite high pain intensity scores; those who gave these discordant ratings were significantly concerned about tolerance, side effects, and about addiction.

### *Pain Intensity Following Arthroplasty*

The findings of the pain experienced by patients in this study is consistent with several previous studies that demonstrated that most patients who undergo knee or hip arthroplasty experience moderate to severe levels of postoperative pain (3, 5, 6, 43). In fact, the criteria for the definition of moderate to severe pain were stricter in our study than in other studies that examined this variable. Previous studies define moderate to severe postoperative pain as a score of  $\geq 3$  on the Numerical Rating Scale. We chose to

define moderate to severe pain as a score of  $>5$  for several reasons; it is both the mean and median of the distribution, and it makes clinical sense. If we had chosen to set this point lower, there would have been an even higher incidence of moderate to severe pain in our study population. The fact that the numbers remain high despite the stricter criteria only lend further support to the finding that significant unrelieved postoperative pain remains a problem. Most patients in the study had their pain managed with patient-controlled analgesia, with a large percentage receiving epidural PCA. This implies that, despite numerous advances in pain management technology, the ratings of pain intensity reported by patients today are no lower than those recorded decades ago. Postoperative pain management continues to be a significant problem.

Our findings regarding the relationship between expected and actual pain adds to a literature that has provided contradictory data. Several previous studies suggested that patients expect more pain than they actually experience (39, 40), while others demonstrated that postoperative pain intensity exceeds patient expectations (38, 49). Our study results support the findings of Nay and De Groot (38, 49), that most patients expect to experience severe pain following surgery, and although most do experience significant pain, the average intensity level is lower than expected.

The data from our study suggest that patient expectations of pain following surgery are a significant problem. Patients in our study were more likely to report that their goals for pain management were met if they had greater differences between the pain they expected and the pain they experienced. This suggests that patients will give high ratings for the quality of their pain management even if their pain is severe, as long as it isn't as severe as they expected. We would argue that patients are therefore giving

high quality ratings, at least in part, for the wrong reason. Their expectations are influencing their ratings of quality, and this relationship makes it difficult to assess how well we are managing pain. It also raises the difficult question of how we should address patients' expectations of pain.

### *Ratings of the Quality of Pain Management*

The high rate of satisfaction with pain management in our study was similar to reports of satisfaction in previous studies; overall, patients who undergo knee or hip arthroplasty are satisfied with their pain management. Previous studies of quality of pain management focus on patient satisfaction; our study assesses quality of pain management more carefully by elucidating the factors associated with both patient satisfaction and meeting goals for pain management.

### *Patient Attitudes and Beliefs*

As hypothesized, we found that substantial numbers of patients endorse beliefs that are potential barriers to providing good pain management. Previous studies on patient attitudes and beliefs about pain and pain management were performed almost exclusively in patients with cancer (47, 50, 51). This is the first study that we are aware of that examines variables of the Barriers Questionnaire, originally designed to assess attitudes about pain in cancer patients, in the postsurgical population. The findings in our study have important implications for targeted areas of patient education. A significant number of patients in the study believed that pain is a necessary part of the healing process and that all patients must experience some pain in order to properly and fully

recover. This may be due to a myth that pain is part of the physiologic process of healing and not also an independent component of injury secondary to surgery. Patients may also believe that complete pain relief is impossible, with the implication that pain is “necessary” because it is unavoidable. An additional item in the survey (data not presented) lends support to this theory. The item asked patients if they could hypothetically choose the precise level of pain that they would experience following surgery, which level of pain they would select. Many patients chose to have “some pain,” rather than “absolutely no pain.” When asked in a free response question why they chose that answer, the majority of patients replied that it was simply “impossible” to have no pain.

Many patients in the study agreed that doctors and nurses find discussions about pain annoying. If patients are afraid to ask their doctor or nurse for pain medication, their pain will not be managed as effectively as it could be. If patients attempt to avoid annoying their providers they may also be more reluctant to ask for medication to relieve side effects such as nausea and vomiting, pruritis, or problems with sleep. Significant numbers of patients were also concerned about building tolerance to the medication, about developing side effects from the medication, and about becoming addicted to the medications they are prescribed for pain. These areas all imply important areas for patient education that may not be presently addressed by caregivers. They suggest that patient education should focus on several key areas: the fact that pain is not necessary for healing and can be avoided, that healthcare providers are not annoyed by discussions about pain, and that tolerance and addiction are unlikely to develop when opioids are used in the acute setting for the purposes of pain management.

### *Factors Associated with Meeting Goals and Satisfaction*

Our study identified several factors that were associated with meeting goals for pain management and with satisfaction. We found that pain intensity was associated with meeting goals for pain management, but not with satisfaction with pain management. This was unexpected and may be due to patient interpretations of the words “goal” versus “satisfaction.” “Goal” may be more meaningful to patients as a *level* of pain, and may be less suggestive of other variables, such as the influence of doctors and nurses, than the word “satisfaction.” For example, it may be easier for patients to mentally prepare for a “goal” of having no pain, but to be “satisfied” with how quickly the nurses respond to their requests for pain medication. If nurses had a slow response time, patients may be more likely to associate this with their ratings of satisfaction rather than their goals for pain management. They would therefore have these associations in mind when they give their ratings of meeting goals or satisfaction with pain management. Although patient interpretations of these two words may account for the difference in our findings, the results are unexpected. We anticipated that pain intensity would be associated with both measures.

Meeting goals for pain management was associated with the difference between the pain that patients expected to experience and the pain that they actually experienced following surgery. Although the result was not statistically significant, there was a trend toward patient expectations also influencing satisfaction. Our results are contradictory to previous reports in the literature that patient expectations of pain have no influence on quality ratings (47). Expectations may influence quality ratings secondary to feelings of



relief on the part of the patient; if they expect the pain to be excruciating or unbearable, they may be pleased when the pain is “only” severe, but not unbearable. Patients may have goals of avoiding a pain score of 10, so even when their score is a 9, they feel that their goal was met.

Previous studies have demonstrated that patients whose sleep is not disturbed by pain are more satisfied with their pain management. We found added support for this finding and added the measure of meeting goals for pain management, which was also associated in our study with pain not interfering with sleep. These results may be representative for how pain impacts patients’ quality of life. In the hospital, unrelieved pain does not inhibit patients from performing daily activities. Outside of the hospital, pain is problematic for patients because it inhibits them from doing these essential or enjoyable tasks. Sleep is an activity that can be compromised by unrelieved pain, and we have demonstrated here that impact on a necessary activity is associated with low scores for quality of pain management.

We identified a trend of physician discussion about pain, including discussions about how pain will be managed following surgery and the level of pain that patients should expect following surgery, being associated with meeting goals for pain management but not with patient satisfaction. Although we hypothesized that communication would be associated with both patient satisfaction with pain management and meeting goals for pain management, we only found an association for one of the measurements of quality of pain management. This result was somewhat unexpected, as physician communication may be expected to influence patient satisfaction. The variables asking patients to recall physician discussion about pain may be problematic,

since patients were asked to remember an event that occurred before surgery. Therefore, there may be an element of recall bias influencing patient responses.

#### *Discordance between Meeting Goals, Patient Satisfaction, and Pain Intensity Scores*

The results of this study support our fourth hypothesis, that discordance exists between the intensity of postoperative pain that patients experience and their ratings of the quality of their pain management, including their satisfaction with pain management and how well their goals for pain management are met. We confirmed prior studies by Svensson and others that previously identified this discordance (37, 42-45). Our study differed from these previous studies, which only examined the relationship of pain intensity to satisfaction. We examined a second rating of quality by assessing how well patients' goals for pain management were met. This study also differed in that we asked patients about their pain intensities and ratings of quality within 48 hours following surgery, while previous studies gathered patient opinions through questionnaires mailed in the weeks following surgery. Our study showed that the discordance between pain intensity and ratings of quality of pain management occurs at an even higher rate than identified by these earlier studies. We found that 70% of patients who report a pain score of >5 were satisfied with their pain management, and 50% of patients with a pain score of >5 felt that their goals for pain management are met. If our criteria for defining moderate to severe pain had been set at a lower value on the NRS scale, as in previous studies, the discordance would likely have occurred at an even higher rate, as most patients in the study gave high ratings for the quality of their pain management.

We found that several of the attitudes and beliefs about pain management that were endorsed by patients may account for the discordance between the high levels of pain that patients experience following surgery and the high ratings they give for satisfaction and meeting pain management goals. To our knowledge, this question has not been addressed by previous studies on patient satisfaction with pain management. Prior studies have independently examined barriers to pain management in patients with cancer and have identified the discrepant relationship between pain intensity and satisfaction, but none have assessed whether or not those barriers account for the discordance. Patients who met their goals for pain management but who had high pain intensity scores were concerned about building tolerance to their medication and about side effects; they were also likely concerned about becoming addicted to their pain medication. Patients who were satisfied but who had high pain scores were concerned both about building tolerance to their pain medication and about addiction. If patients are significantly concerned about these issues, they may prefer to have higher levels of pain to avoid pain medication. The identification of these barriers highlights important areas for patient education. Patient education should focus on informing patients that the risk of addiction to pain medications in the acute setting for purposes of pain management is very low, and that there is little to no risk of building tolerance to the medications when administered over only a few days. Patients should be educated about side effects and their management prior to surgery.

A second implication of this finding is that clinicians and researchers may need to change the way that we evaluate the quality of pain management. It has been suggested that patients' true opinions may be modified to please the interviewer, and lower rates of

satisfaction have been reported in studies that gather patient opinion by anonymous survey (45). This suggests that clinicians and researchers may need to evaluate patient satisfaction and ratings of meeting goals for pain management anonymously to more accurately assess the quality of our pain management.

### *Strengths and Limitations*

One strength of this study is the strictness of the criteria set for the definition of moderate to severe pain. As discussed above, our study set this distinction as a score of  $>5$ , while others set  $\geq 3$  as that point. We have demonstrated significant results even with these stricter criteria

There are very few studies that distinguish, within the same patient population, the difference between patient satisfaction with pain management and meeting goals for pain management. This is a strength of this study, as we have two separate indicators for the quality of pain management within the same study population. This distinction enabled us to identify factors associated with satisfaction with pain management as well as factors associated with meeting goals for pain management. This provides a more detailed assessment of the quality of pain management in our study population. Our study also included a thorough assessment of both intensity ratings and quality ratings, which allowed us to examine how these two variables were related. We also moved beyond previous studies in elucidating the reasons for the discrepancies between ratings of intensity of pain and the quality of pain management.

There are several limitations to this study. Significant numbers of patients did not answer the survey items that addressed potential barriers to pain control; with an already

small patient population, we recognize the impact that 15% missing answers may cause. Another limitation of the study is that patients were asked about their expectations of pain prior to surgery after the surgery had already occurred. We recognize that patients' responses to this question could be affected by their actual experiences, and it would have been ideal to assess their expectations prior to the actual event of surgery.

The total number of enrolled patients (68) is substantially lower than the number that we expected to enroll based on the number of arthroplasty surgeries performed annually at Yale-New Haven Hospital (approximately 300). We do not have a denominator for the number of eligible patients who were approached for participation but who refused participation or who were eligible but not approached. There were 30 documented potential study participants who declined participation, but the study recruiter estimates the actual number approached but who declined to be significantly higher. She was not able to document each refusal due to her significant and simultaneous clinical responsibilities. Of note, the number of patients who were not approached due to selection criteria exclusion cannot be separated from the number missed entirely due to the reasons outlined above.

There were two major categories of barriers to patient enrollment in the study; barriers to approaching patients for enrollment and barriers to patients participating once they were approached. The major barrier to approaching patients for enrollment was the HIPAA requirement that patients may only be approached for participation in the study by a member of the healthcare team directly involved in their care. The only qualified individual available to recruit patients was a single member of the nursing staff on the floor that cares for the highest number of postoperative orthopedic patients. The time

constraints faced by the nurse who acted as the sole participant recruiter was a second significant barrier to approaching patients for the study. The third barrier to enrolling was in the availability of the primary investigator. To help overcome these barriers, three Yale University undergraduate research assistants were hired to assist in the final year of data collection. Thirty-two of the study participants were interviewed by the primary investigator (LCS) in the first two years of the study, and the remaining 36 were interviewed by the research assistants in the final 18 months of the study.

There were multiple barriers to patients participating in the study once they were approached. While the precise reason for refusal to participate was not recorded, there are several potential reasons why patients likely refused participation in this study. In order to most accurately record levels of pain in the immediate postoperative period, all patients were approached for participation in the first 48 hours postoperatively. Patients who undergo knee or hip arthroplasty typically experience severe pain postoperatively, with the highest levels of pain occurring in the first 48 hours following surgery. The patient population for this study was therefore likely experiencing significant pain, making them less likely to participate in a lengthy survey focused on discussing that pain. An additional reason for patient refusal to participate was likely the high doses of pain medications, namely opioids that most patients were taking at the time they were approached. The sedative nature of these medications made it difficult for many patients to remain awake and alert long enough to understand the study objectives and consent to participation.

## Summary

Most patients experience moderate to severe pain following arthroplasty. Patients in this study expected to experience more pain than they actually had following surgery. Meeting goals for pain management was associated with a greater difference between expected and actually experienced pain, suggesting that patients gave high ratings for quality even if their pain was severe, as long as it was not as severe as they expected. Patient expectations are therefore a significant problem, and patients are giving high ratings of quality, at least in part, for the wrong reasons. Patients whose goals for pain management were met and who were satisfied with their pain management were less likely to report that pain interfered with their sleep. This suggests that patients' ratings of quality of pain management are influenced by the effect of pain on necessary daily activities. Our study supports the findings of previous studies that identified discordance between the pain that patients experience and their ratings of the quality of their pain management. A substantial number of patients are satisfied with their pain management and feel that their goal for pain management is met despite experiencing moderate to severe pain following surgery. We identified several possible reasons for this discrepancy, including patient concerns about tolerance and addiction. The study also demonstrated that substantial numbers of patients endorse beliefs that may be barriers to effective pain management, including beliefs that pain is a necessary part of the healing process and that healthcare providers are annoyed by discussions about pain. These findings identify an important area where targeted education would be helpful in improving patient knowledge about pain. This education could also enable patients to

give ratings for the quality of their pain management that more accurately reflects how well we are managing postoperative pain.



## Appendix 1: Postoperative Pain Study Survey Instrument

### Q=Question

### A=Possible Answer choices

1. Q: What date were you admitted to the hospital for your surgery?  
A: Free response by patient
2. Q: What is the day of your birth?  
A: Free response by patient
3. Q: Do you consider yourself Hispanic or Latino?  
A: Yes, No
4. Q: Do you consider yourself:  
A: Black or African American, White, Native Hawaiian or other Pacific Islander, American Indian or Alaskan native, more than one race, or other
5. Q: Record gender of the participant  
A: Male, Female
6. Q: What was the highest grade or year of school that you completed?  
A: Did not complete high school, high school, college, graduate degree
7. Q: What is your current marital status?  
A: Married, Separated, Divorced, Widowed, Never Married
8. Q: In general, how do your finances usually work out at the end of the month?  
Do you find that in general you have:  
A: Some money left over, just enough to make ends meet, not enough to make ends meet
9. Q: Have you ever been diagnosed with any of the following conditions:  
a) coronary artery disease, b) congestive heart failure, c) COPD,  
d) emphysema, e) chronic renal disease, f) hypertension, g) dementia, h) cancer.  
A: Yes, No. If no to h), skip to #11.
10. Q: Which type of cancer have you been diagnosed with?  
A: Free response by patient
11. Q: Have you ever undergone any of the following surgical procedures: a) previous joint replacement, b) coronary artery bypass grafting, c) hernia repair, d) cholecystectomy, e) surgical removal of renal stones, f) tonsillectomy, g) another surgery not listed?  
A: Yes, No
12. Q: Most recently, what type of surgery did you undergo?  
A: Partial knee replacement, total knee replacement, unilateral, total knee replacement, bilateral, partial hip replacement, total hip replacement
13. Q: Were you regularly taking any of the following non-steroidal anti-inflammatory drugs (NSAIDs) in the weeks or months prior to your surgery: a) aspirin, b) motrin, c) aleve, d) viox, e) celebrex, f) another NSAID that was not listed?  
A: Yes, No. If no, skip to #17

14. Q: How much and how often were you taking (NSAID mentioned)?  
A: Free response by patient
15. Q: Did your doctor instruct you to stop taking (NSAID mentioned above) prior to your surgery?  
A: Yes, No
16. Q: When did you stop taking your NSAID?  
A: Less than 1 day before surgery, 1-2 days prior to surgery, 3-4 days prior to surgery, 5-6 days prior to surgery, 1 week prior to surgery, 2 weeks prior to surgery, more than 2 weeks prior to surgery.
17. Q: At any time since you arrived at the hospital, have you needed treatment for pain?  
A: Yes, No
18. Q: Have you experienced any pain the past 24 hours?  
A: Yes, No
19. Q: On a scale of 0-10, with 0 being no pain and 10 being the worst pain, what is the average amount of pain you have experienced in the past 24 hours?  
A: Numbers 0-10
20. Q: These faces show varying amounts of pain or discomfort. This face shows no pain. These faces show more and more pain up to this one—it shows a lot of pain. Point to the face that shows how much pain, on average, you had over the past 24 hours.  
A: Patient points to face on scale
21. Q: On a scale of 0-10, with 0 being no pain and 10 being the worst pain, what was the worst pain you had immediately upon waking up from surgery?  
A: Numbers 0-10
22. A: Numbers 0-10
23. Q: Point to the face that shows how much pain you had immediately upon waking up from surgery.  
A: Patient points to face on scale
24. Q: On a scale of 0-10, with 0 being no pain and 10 being the worst pain, how much pain are you having right now?  
A: Numbers 0-10
25. Q: Point to the face that shows how much pain you are having right now.  
A: Patient points to face on scale
26. Q: On a scale of 0-10, with 0 being no pain and 10 being the worst pain, what is the worst pain you have had since your surgery?  
A: Numbers 0-10
27. Q: Select the phrase that describes how satisfied you are with the way your doctors treated your pain.  
A: Very satisfied, slightly satisfied, slightly dissatisfied, very dissatisfied
28. Q: Why did you give that rating?  
A: Free response by patient
29. Q: Select the phrase that describes how satisfied you are with the way your nurses managed your pain.  
A: Very satisfied, slightly satisfied, slightly dissatisfied, very dissatisfied
30. Q: Why did you give that rating?  
A: Free response by patient

31. Q: When you asked for pain medication, what was the longest time you had to wait to get it?  
A: 15 min or less, 15-30min, 30-45min, 45-60min, >60min, never asked for pain medication
32. Q: Was there ever a time when the medication you were given for pain didn't work and you asked for something more or something different to relieve your pain?  
A: Yes, No. If no, skip to #34
33. Q: How long did it take before your doctor or nurse gave you something more or something different for your pain?  
A: 1 hour or less, 1-2 hours, 2-4 hours, 4-8 hours, 8-24 hours, more than 24 hours
34. Q: Since you came to the hospital, did your doctor or nurse ask you to notify them when you had pain?  
A: Yes, No
35. Q: Approximately how many times since your surgery have you experienced nausea or vomiting?  
A: Free response by patient
36. Q: Approximately what percentage of the time did unrelieved pain interfere with your sleep?  
A: 0%, 1-10%, 11-20%, 21-30%, 31-40%, 41-50%, 51-60%, 61-70%, 71-80%, 81-90%, 91-100%
37. Q: Did you attend the Preoperative Joint Replacement Course offered by the hospital?  
A: Yes, No
38. Q: On a scale of 0-10, with 0 being no pain and 10 being the worst pain, what is the average amount of pain you expected to experience following your surgery?  
A: Number 0-10
39. Q: Point to the face that shows the average amount of pain that you expected to experience following your surgery.  
A: Patient points to face on scale
40. Q: Before your surgery, did your doctor speak with you about the severity of pain that he or she expected you may experience following surgery?  
A: Yes, No. If not, skip to #42.
41. How severe did your doctor tell you that your pain might be following surgery?  
A: Severe, moderate, mild, no pain
42. Q: Do you know the names of the medications that your doctors and nurses are using to treat your pain?  
A: Yes, No. If no, skip to #45.
43. Q: What are the names of the medications you are taking for pain?  
A: Free response by patient
44. Q: Do you know the type(s) of medication(s) that (medications mentioned in #43) are?  
A: Yes, No. If no, skip to #46.
45. Q: What type of medications are they?  
A: Free response by patient.
46. Q: Are you aware of any side effects that may result from your pain medications?

- A: Yes, No
47. Q: Have you ever been told that the medications that you are taking for pain may cause any of the following symptoms: a) itching, b) nausea or vomiting, c) headache, d) drowsiness, e) feelings of confusion or disorientation, f) tremors or chills, g) constipation, h) difficulty urinating  
A: Yes, No
48. Q: Have you previously taken any medications for pain?  
A: Yes, No. If no, skip to #52
49. Q: What are the names of the medications that you have previously taken for pain?  
A: Free response by patient
50. Q: Have you previously experienced any side effects from medications that you've taken for pain?  
A: Yes, No. If no, skip to #52
51. Q: Have you ever experienced any of the following symptoms after taking pain medications: a) itching, b) nausea or vomiting, c) headaches, d) drowsiness, e) feelings of confusion or disorientation, f) tremors or chills, g) constipation, h) difficulty urinating?  
A: Yes, No
52. Q: Before your surgery, did your doctor or nurse explain how your pain would be treated following your surgery?  
A: Yes, No
53. Q: Before your surgery, did your doctor or nurse explain any side effects that may result from the medications you would be taking for pain?  
A: Yes, No
54. Q: Is your pain being managed using PCA (pump) therapy?  
A: Yes, No. If no, skip to #59
55. Q: Has anyone told you how often you can push your pump button?  
A: Yes, No. If no, skip to #57
56. Q: How often did they say you can push it?  
A: Free response by patient
57. Q: On average, how many times per hour do you push your pump button?  
A: Once every few hours, 1-2 times per hour, 3-4, 5-6, 7-8, 8-9, 9-10, more than 10 times, never push pump button
58. Q: When you are experiencing pain, do you push your pump button:  
A: Every time you have pain, some of the time when you have pain, hardly ever when you have pain, never when you are having pain
59. Q: Do you consider yourself someone who would prefer to make your own choices about pain management, or do you consider yourself someone who would prefer that a caregiver such as a doctor or nurse make the decisions about treating your pain?  
A: Prefer to make decisions, prefer to have doctor or nurse make decisions
60. Q: If you were able to choose precisely how much pain you would have following surgery, what would your ideal level of pain be?  
A: Totally pain free, almost pain free but with some pain, have moderate amounts of pain, prefer to have pain untreated.

61. Q: Patients may have different reasons for wanting to experience varying levels of pain following surgery. Why would you prefer to have (choice selected from #60)?  
A: Free response by patient
62. Q: How well do you feel that your goal of experiencing (choice selected in #60) was achieved?  
A: Very well, well, fair, poor, not at all
63. Q: Drugs known as opioids, which fit into a family of drugs called narcotics, are sometimes used to treat moderate to severe pain following surgery. Some examples of opioids are morphine, percocet, and codeine. Sometimes patients are concerned about becoming addicted to these drugs if their doctors prescribe them for pain following surgery. How concerned are you about becoming addicted to the medications that you are taking for pain?  
A: Very concerned, somewhat concerned, somewhat unconcerned, very unconcerned
64. Q: Does your concern about becoming addicted to your pain medication influence how many times per hour you hit your pump button?  
A: Yes, No, N/A
65. Q: Some patients are concerned about taking pain medications too soon because they believe that they may build tolerance to the medication, and the medication will then not be effective if their pain gets worse. They believe that the medication should be saved for when they “really need it.” How concerned are you about building tolerance to your pain medications by taking them too soon following surgery?  
A: Very concerned, somewhat concerned, somewhat unconcerned, very unconcerned
66. Q: Does your concern about taking pain medications too soon and having them stop working influence how many times per hour you hit your pump button?  
A: Yes, No
67. Q: Sometimes patients experience side effects such as nausea, vomiting, itching, constipation, headaches, or drowsiness when taking certain pain medications. Some patients who have surgery have experienced these side effects from medications they have taken in the past and are concerned that they may experience these effects again when taking pain medications following surgery. How concerned are you about the potential side effects that may result from the medications you are taking for pain?  
A: Very concerned, somewhat concerned, somewhat unconcerned, very unconcerned
68. Q: Does your concern about side effects from your pain medications influence how many times you push the button on your pump?  
A: Yes, No
69. Q: Which side effect are you most concerned about?  
A: Nausea, vomiting, drowsiness, constipation, difficulty urinating, headaches, confusion, itching, none of these concern me

70. Q: Please rate your response to the following statement: If my pain is completely eliminated, then my doctor will no longer actively treat or rehabilitate my knee/hip condition.  
A: Strongly agree, agree somewhat, disagree somewhat, strongly disagree
71. Q: Please rate your response to the following statement: Pain is a necessary part of having surgery, and all patients should experience some pain in order to properly and fully recover.  
A: Strongly agree, agree somewhat, disagree somewhat, strongly disagree
72. Q: Please rate your response to the following statement: I am hesitant to report to my doctors or nurses when I have pain because 'good patients' should not complain about pain.  
A: Strongly agree, agree somewhat, disagree somewhat, strongly disagree
73. Q: Please rate your response to the following statement: Healthcare professionals such as doctors and nurses find it annoying to talk about pain.  
A: Strongly agree, agree somewhat, disagree somewhat, strongly disagree
74. Q: Please rate your response to the following statement: I am hesitant to report to my doctors or nurses when I have pain because having pain must mean that my knee/hip replacement is not working properly, or that something must be going wrong.  
A: Strongly agree, agree somewhat, disagree somewhat, strongly disagree
75. Q: What do you like about the way that your nurses managed your pain?  
A: Free response by patient
76. Q: What do you like about the way that your doctors managed your pain?  
A: Free response by patient
77. Q: What suggestions would you make for how your nurses could improve the way they managed your pain?  
A: Free response by patient
78. Q: What suggestions would you make for how your doctors could improve the way they managed your pain?  
A: Free response by patient

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