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Outcomes of Rotator Cuff Surgery in Utah Workers' Compensation Patients

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OUTCOMES OF ROTATOR CUFF SURGERY IN UTAH WORKERS' COMPENSATION PATIENTS

by

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ABSTRACT

Outcomes of Rotator Cuff Surgery in Utah

Workers' Compensation Patients

by

Jennifer R. Grewe, Doctor of Philosophy

Utah State University, 2011

Major Professor: Dr. M. Scott DeBerard
Department: Psychology

Currently, rotator cuff injuries are the most common problem for the shoulder and accounted for 4.1 million physicians visits. Partial and full thickness tears are more common in people over the age of 50. The increased prevalence of rotator cuff injuries in the United States population certainly affects the working population and often represents a significant economic burden for employers. Few studies have examined outcomes in worker compensation patients or considered biopsychosocial predictive variables for rotator cuff repairs. The current study aimed to characterize injured workers who have undergone rotator cuff repairs across a number of pre- and postprocedural variables, evaluate multidimensional functional and quality of life outcomes, and examine biopsychosocial variables predictive of success and failure in this sample.

The current study examined 93 injured workers who had undergone at least one rotator cuff repair within the past five years. Participants were solicited through the Worker's Compensation Fund of Utah (WCF) computerized database. The current study

used a retrospective cohort design, patients' medical charts were reviewed, and various preprocedural variables were coded for analysis including age at the time of the rotator cuff repair, lawyer involvement in the claim, prior shoulder surgery history, and quantity of other compensation claims. Of the total sample, 47 patients (50.5%) were contacted and completed outcome surveys that assessed patient satisfaction, shoulder functional impairment, disability status, and general physical and mental health functioning.

Findings revealed that approximately one third of the patients were totally disabled (29.8%), had poor shoulder specific functioning (36.2%), and were dissatisfied with their current shoulder condition (31.7%). A multivariate regression model was utilized in predicting patient outcomes. Specifically, the number of WCF claims of the patient was a robust predictor of multidimensional outcomes, while age and gender were less predictive of outcomes, and the presence of a prior shoulder surgery reflected no predictive power. Results of descriptive, correlational, and regression analyses are compared to existing data for rotator cuff repair patients when available or to other surgical procedures with similar populations. The study limitations are discussed, such as small sample size, the retrospective design, and lack of matched controls.

(155 pages)

PUBLIC ABSTRACT

Outcomes of Rotator Cuff Surgery in Utah

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The rotator cuff is responsible for the lifting function of the shoulder and the circular movement of the arm. Rotator cuff injuries are the most common problem for the shoulder and account for approximately 4.1 million annual physicians visits. Approximately 20.7% of the population has at least one rotator cuff tear and more than 75,000 individuals will have rotator cuff surgery each year. Medical and compensation costs associated with a rotator cuff surgery are increasing and current estimated annual costs exceed 2 billion dollars. The increasing prevalence and cost associated with rotator cuff injuries in the United States population represents a significant economic burden for employers. Given the high prevalence of rotator cuff surgeries in the workers compensation population, and the growing costs associated with these procedures, it is important to investigate the cost associated with rotator cuff repair surgeries and the potential psychosocial factors related to these costs.

The current study examined compensation variables of Utah workers that received a rotator cuff injury on the job and underwent a rotator cuff repair surgery from 2007 to 2009. Participants were obtained by review of the Worker's Compensation Fund of Utah computerized database and various preprocedural variables were coded for analysis. Of the total sample, 47 participants (50.5%) were contacted and completed the follow-up outcome surveys.

Study results found that approximately one third of the patients were totally disabled (29.8%), reported poor shoulder functioning (36.2%), and were dissatisfied with their current shoulder condition (31.7%). The number of Workers' Compensation Fund claims was a strong predictor of multiple patient outcomes, while age and gender were less predictive and the presence of a prior shoulder surgery revealed no predictive power. Results are compared to existing rotator cuff repair patients' data when available and to similar populations that have undergone other surgical procedures. Study results are discussed as well as study limitations.

(155 pages)

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CHAPTER I

INTRODUCTION

The rotator cuff is an important component of the shoulder. The rotator cuff consists of four muscles or tendons that function to support and move the shoulder. The four muscles that function as the rotator cuff are the supraspinatus, infraspinatus, teres minor, and subscapularis muscles. The rotator cuff is responsible for the circular movement of the arm and the lifting function of the shoulder. Rotator cuff injuries are the most common problem for the shoulder, and in 2006 accounted for over 4.1 million physicians visits (Turkelson & Zhao, 2009).

The muscles of the rotator cuff become weaker with age thus making a person more susceptible to injury to this area of the shoulder (Lehman, Cuomo, Kummer, & Zuckerman, 1995; Milgrom, Schaffler, Gilbert, & Van Holsbeeck, 1995; Worland, Lee, Orozco, SozaRex, & Keenan, 2003). Pain, stiffness, decreased range of motion, and cracking are common symptoms in the shoulder of a rotator cuff tear (American Academy of Orthopaedic Surgeons, 2007; AAOS). Partial and full thickness tears are more common in those over the age of 50 (Milgrom et al., 1995). The prevalence of rotator cuff injuries is likely to increase in the United States as the current working population ages.

Repairing a rotator cuff injury can increase quality of life for a person. Increased quality of life for a person with a rotator cuff injury translates into reduced pain and increased physical functioning in the shoulder joint. Research with surgical rotator cuff repairs has shown that patients typically report an increase in their quality of life at 6

months postsurgery (Levy et al., 1999). Quality adjusted life years (QALY) are quantitative descriptions of factors that determine both a person's quality and quantity of life given a specific treatment. Calculation of QALY helps compare different treatment options for the same or different conditions. For example, one treatment may help a person live longer but also has serious side effects while another treatment option may not help the person live as long but greatly improves quality of life. Some of the factors used to calculate the QALY are the monetary value of the treatment, health outcomes of treatment, and risks of the treatment. Thus to calculate QALYs the number of additional years of life gained by the intervention are multiplied by the quality of life (ranging from 0 being death to 1 being perfect health). For patients postrotator cuff surgery, there was an estimated lifetime gain of 1.81 years for the worst-case scenario and 2.32 years for the best-case scenario, which is comparable or better than other surgical procedures such as a knee or hip replacement (Levy et al., 1999).

In 2007, a cost-analysis of rotator cuff repairs estimated total average costs of rotator cuff repair (RCR) to be $10,605 (Vitale et al., 2007). The cost of an increased QALY for rotator cuff falls between $3,091 and $13,092. The amounts reported reflect the monetary value that it costs to increase a persons' life by one quality year given the intervention. Rotator cuff surgical repair QALY can be compared to other surgical or medical procedures including total hip arthroplasty that costs $8,700, for a QALY, coronary artery bypass that costs $37,400 for a QALY, and $63,000 for QALY for renal dialysis (Vitale et al., 2007). Although the cost of an increased QALY is more variable than other medical procedures, it is also less expensive. Decreasing the risks and

improving health outcomes of rotator cuff repair surgery could both decrease the variability and lower the cost of a QALY.

The increased prevalence of rotator cuff injuries in the United States population certainly affects the working population and often represents a significant economic burden for employers. On the job injuries cost employers over $406 billion in 2000 because of lost productivity and medical treatment (Corso, Finkelstein, Miller, Fiebelkorn, & Zaloshnja, 2006). Workers compensation is a wage replacement and insurance program for those that are injured on the job. Injuries to the shoulder are responsible on average for more time away from work than any other injury and 76,000 workers required time away from work for a shoulder injury in 2009 (U.S. Department of Labor, 2009a; USDL).

Manual laborers that frequently lift heavy objects can be at a greater risk for rotator cuff injuries. A fall, blow to the shoulder, or other traumatic injury can result in a full or partial thickness tear of the rotator cuff. Repetitive overuse can result in a tear and chronic degeneration of these muscles. Heavy overhead lifting can increase the risk of a rotator cuff injury (AAOS, 2007). Pain from a rotator cuff injury could present immediately or up to a few months after the injury. Physical symptoms of rotator cuff injury include stiffness and weakness of the shoulder, pain, crackling of the joint, and limited range of motion (AAOS, 2007).

There are a variety of surgical options for repairing a RCR. The type of procedure performed depends on the extent of the tear, pain severity, and immobility of the shoulder (Calvagna, 2009). Usually surgical repair of the rotator cuff involves removing loose tendon or other material that could be decreasing function, ensuring the

muscles have room to function, and repairing the portion of the cuff that has been injured. Open RCR involves exposing the area with a 2- to 3-inch incision and repairing as described above (Nho et al., 2007; Ramsey, Getz, & Parsons, 2009). Arthroscopic surgery consists of inserting a camera and light through an opening by which the surgeon can view the shoulder. Instruments are inserted through a small incision and movements are guided by the images from the camera (Erstad, 2008). Mini-RCR involves components of both arthroscopy and open repair. A camera is inserted into a small incision to view the injury and the tear is repaired through separating the deltoid muscles (Erstad, 2008; Sperling, Smith, Cofield, & Barnes, 2007).

On average, rotator cuff surgical patients indicate a decrease in pain and report they are satisfied with the procedure used to repair the injury, regardless of the type of surgery. Despite the fact that on average most people are satisfied with the procedure used, it is not possible to make predictions about individual outcomes without further information (Romeo, Hang, Bach, & Shott, 1999; Watson & Sonnabend, 2002). Predictions about what type of outcome a person can expect as a result of RCR surgery continue to be difficult to make. More information is needed to determine factors that could improve a person's rotator cuff surgical outcome. Many researchers within the area of spine surgery suggest that the variances in back surgery outcomes are due to biopsychosocial variables (Epker & Block, 2006; LaCaille, DeBerard, Masters, Colledge, & Bacon, 2005; Linton, 2000). Although the importance of specific biopsychosocial factors has been established within the back surgery literature, little is known about biopsychosocial factors that influence recovery within the RCR research. More quality studies and information about RCR patients' biopsychosocial factors is required to

determine the potential causes for successful outcomes among patients (Morse et al., 2008).

The relationship between compensation status and poorer outcomes has been established within the research on rotator cuff surgical repairs (Watson & Sonnabend; 2002). Poorer outcomes reported by compensated patients include higher levels of pain, longer recovery times, and more psychological distress (Greenough, Peterson, Hadlow, & Fraser, 1998; Harris, Mulford, Solomon, van Gelder, & Young, 2005). Compensated populations are still found to benefit from rotator cuff surgical repairs despite reporting more pain and disability than noncompensated populations following the procedure (Holtby & Razmjou, 2009).

There are certain factors within the rotator cuff literature that might be predictors of poorer outcomes. Predictors associated with worse outcomes have been reported by various studies including: tears greater than 5 cm, older women, presence of a bicep tendon rupture, patients younger than 55, a repair to fix the initial repair (or a revision), and patients receiving Workers' Compensation (Holtby & Razmjou, 2009; Romeo et al., 1999; Watson & Sonnabend, 2002). The severity of the rotator cuff tear can be determined during surgery or postmortem. Small tears are defined as < 1 cm, medium 1 to 3 cm, and large to massive tears, which are greater than 5 cm. Pain severity and shoulder functioning can relate to the size of the RCR with larger tears being associated with worse outcomes. Most rotator cuff tears occur in the supraspinatus due to the location and lifting function of this muscle (AAOS, 2007). More information is needed about the association between patient characteristics, demographic variables, and physiological characteristics to determine if these factors are related to poorer outcomes.

Previous research regarding RCR contains a lack of reported information about patient characteristics and the quality of reported findings have limited the comparisons that could be made between poor, good, and excellent repair outcomes (Holtby & Razmjou, 2009; Koljonen, Chong, & Yip, 2007; Morse et al., 2008).

Given the high prevalence of rotator cuff surgeries in Workers' Compensation patients, and the lack of information on the factors associated with poorer outcomes linked to this surgical group, the purpose of this study is to investigate three primary objectives: (a) to describe presurgical biopsychosocial status of Utah workers that underwent rotator cuff repair surgery, (b) to examine postsurgical outcomes following rotator cuff repair surgery (e.g., physical functioning, quality of life, overall health status, and rates of failure, patient satisfaction, and return to work), and (c) to examine if presurgical variables (i.e., patient characteristics, health behaviors, psychosocial variables) are predictive of rotator cuff repair outcome variables.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The review of the literature examines the relevant prevalence and cost information about rotator cuff repairs within the general population and Workers' Compensation populations, reasons for RCR, the RCR procedure, and relevant outcome studies. Outcome predictors will be reviewed from pain population studies to determine possible variables that could influence rotator cuff repair outcomes. Studies were gathered from Medline using keywords associated with RCR.

Prevalence of Rotator Cuff Surgery

The rotator cuff is a critical component of the shoulder. The rotator cuff consists of four tendons and muscles that help to stabilize the shoulder. The four tendons of the rotator cuff are the supraspinatus, infraspinatus, teres minor, and subscapularis muscles. Each of these tendons provides a function for the shoulder (Mayo Clinic, 2008). The rotator cuff is responsible for lifting and the circular movement of the arm. Shoulder pain is the third most common complaint of people that visit the physician due to musculoskeletal disorders, behind back and neck pain (USDL, 2009a). The most common type of shoulder issue is due to rotator cuff problems. Rotator cuff problems accounted for over five million physician visits between 1998 and 2004, increasing 40% during this period (Turkelson & Zhao, 2009). In 2006, the incidence of physician visits for rotator cuff problems increased to 4.1 million (Turkelson & Zhao, 2009). The same year, 1.13 million people visited the emergency room with their main complaint being the shoulder.

Research with rotator cuff injuries suggests that as a person ages they have a greater risk of injuring the rotator cuff (Lehman et al., 1995; Milgrom et al., 1995; Worland et al., 2003). This is because the muscles in the shoulder become weaker and deteriorate with age. Milgrom et al. (1995) examined the shoulders of adults between the ages of 20 and 99. Partial- and full-thickness tears were found to be significantly more prevalent in those over the age of 50 (Milgrom et al., 1995). In another study examining the prevalence of rotator cuff tears, researchers found that 51% of people over the age of 80 had a rotator cuff tear. Thirteen percent of people ages 50-59, 20% of people ages 60-69, and 31% of people ages 70-79 had a rotator cuff tear in the same study (Tempelhof, Rupp, & Seil; 1999). As the older population increases, which is expected to happen in the United States, the prevalence of rotator cuff injuries are likely to increase. Increases in the prevalence of rotator cuff repairs could strain utilization of hospitals' surgical rooms, health care services, and health care resources.

Cost of Rotator Cuff Repair

A health-related quality of life outcome model examines health care as it relates to both a person's quality of health and quantity of life. Often, a health-related quality of life outcome model is compared to a cost effectiveness analysis to determine the cost of increasing the quality of life for a person, considering the financial costs of surgical or medical procedures. Traditional approaches to health care include biomedical models that focus on diagnosis and outcomes specific to that condition (Kaplan, 2003). Increasing a person's quality of life with a RCR includes reducing pain for the patient and increasing the physical functioning of the shoulder.

Although not life saving, surgical RCR have been shown to consistently improve the quality of life of patients. Levy et al. (1999) followed 36 patients undergoing surgical repair of the rotator cuff. The analysis included the costs of the procedure 6 months postsurgery to determine the cost effectiveness of this procedure. Quality of life measures included the European Quality of Life measure (EQoL) and the Health Utilities Index Mark 11 (HUI). The study found that patients reported an increased quality of life 6 months postsurgery as reported by these measures. The patients' scores on the EQoL and HUI improved from 53 and 79, respectively, to mean scores of 78 and 88 postsurgery. The average total cost of a RCR was $12,464. Most of the average cost of the repair was from the operating room charges, surgeons' fees, and hospital charges with the remainder of the fees being due to physical therapy. Best-case outcomes were associated with an increased quality adjusted life years (QALY) of .71 to 2.32 and worst-case scenerio of QALY of .61 to 1.82 (Levy et al., 1999).

Vitale et al. (2007) conducted a cost-analysis of RCR more recently that estimated total average costs of RCR to be $10,605. By comparing the quality of life outcome measures and the costs of this procedure, the study found the cost-effectiveness ratio was $13,092/QALY with the HUI and $3,091/QALY with the EQoL measure. Adjusted quality of life years is comparable or better in RCR than other surgical or medical procedures. Meaning, the cost to increase a persons' quality of life is less for the rotator cuff surgery than for other major medical surgical procedures. For example, total primary hip arthroplasty costs $9,500 for a QALY, $73,900 for a revision hip arthroplasty, and $19,800 for QALY for a total knee replacement arthroplasty (Rasanen et al., 2007).

It should be noted despite studies reporting similar outcomes to the open procedure for RCR, arthroscopic repairs on average are more expensive (Adia, Rowsell, & Pandey, 2009). On average, arthroscopic procedures cost $1,248.75 more than open RCR procedure.

Cost of Workers' Compensation Claims

Workers' Compensation is a wage replacement and medical insurance program designed to assist those that are injured while on the job. The cost of Workers' Compensation for injuries creates a strain upon employers, particularly during difficult economic times. According to estimates generated about costs to U.S. employers, employers pay $1,700 per employee to pay for the cost of this injury insurance (Miller, 1997). More generally speaking, employers, collectively, spend around $200 billion each year for employee injuries (Miller, 1997). More specifically, occupational injuries are a substantial component of the total cost of injuries. On-the-job injuries are responsible for $155 billion of the total amount spent by employers or $1,400 of the per employee cost (Miller, 1997). The losses accumulated by workplace injuries also translate into fewer workdays, which equates to decreased productivity and overall lower employee moral.

Injuries to the rotator cuff may cause weakness, and loss of movement and mobility in the arm. These injuries can result in either short- or long-term disability. The physical symptoms of rotator cuff injury can significantly reduce productivity and increase absenteeism from work. Shoulder injuries are the second most common reason for time away from work among manual laborers, preceded only by back pain **(**Gomoll, Katz, Warner, & Millett, 2004). In 2007, 76,000 people had a work-related shoulder injury that required them to take days off work (USDL, 2007). A survey conducted by the

Occupational Safety and Health Administration in 2002 found that injuries to the shoulder required laborers to take an average of 15 days off work, longer than any other injury. Thirty-seven percent of laborers required more than 31 days off work. The survey also found injuries to the shoulder and back, accounted for 36% of all work incidents, far more than another body part (USDL, 2007).

Indications for Rotator Cuff Repair

The rotator cuff consists of four small tendons and muscles that help provide support and rotation to the shoulder. Severity and the extent of the injury of the rotator cuff tear are related to the length of the tear. Small tears are >1 cm, medium 1 to 3 cm, and large to massive tears, which are greater than 5 cm. The rotator cuff consists of the four tendons of the supraspinatus, infraspinatus, teres minor, and subscapularis. Most rotator cuff tears occur in the supraspinatus due to the location and lifting function of this muscle (AAOS, 2007). The rotator cuff works to lift and rotate the humerus, and stabilize the shoulder joint. The tendons are attached to the back of the scapula and wrap around the top of the humerus to cover the head, serving to hold this bone in place (AAOS, 2007). If the muscles of the rotator cuff become damaged, the humerus can become unstable, leading to disability and chronic pain.

A rotator cuff injury to the shoulder can make it difficult to lift objects, participate in activities/sports, or sleep through the night and can ultimately result in disability. A person suffering with shoulder pain may also experience exhaustion, difficulty concentrating, and depression due to the chronic pain (Block & Callewart, 1999; Craig, Hill, & McMurtry, 1999). Shoulder pain often causes difficulty functioning in daily routines and can interfere with job performance. People that lift objects over their head

(i.e., lift weights, play sports, stack shelves) are at an increased risk of rotator cuff tears, including manual laborers.

A strain, tendonitis, and partial or full rotator cuff tear can cause significant pain in the shoulder. If any of the muscles of the rotator cuff are weak from repetitive use or an injury, this can cause the humerus to not be centered in the middle of the socket of the shoulder. This results in an unusual amount of pressure on the tendons of the shoulder. Pressure on the tendons in the shoulder can result in a partial or full thickness tear of the rotator cuff.

Partial or full rotator cuff tears that result in surgical intervention can be the result of a direct blow, falling on the shoulder or a traumatic injury, in which the person experiences a specific injury to the shoulder (i.e., falling down, a dislocated or fractured shoulder). A tear can also result from chronic degeneration and inflammation of the tendons due to repetitive overuse. Chronic degeneration can be the result of repetitive overhead motions. Any worker that must repetitively reach over their head such as lifting boxes to shelves, particularly heavy lifting overhead could be at risk from this type of injury (AAOS, 2007). Rotator cuff tears also can result from poor posture or any activity where there exists an increased risk of falling or getting hit to the shoulder. As a person ages, they are more susceptible for a rotator cuff tear because the tendons are weaker, and less flexible **(**Biundo, 2008).

Animal models have been used to evaluate different types of injuries as they relate to rotator cuff tear and tendinosis. Rats that had an injury to the muscles exhibited worse outcomes than rats with overuse injuries alone (Carpenter et al., 1998). Previous research with rotator cuff tear suggests that the extent of the tear can effect recovery time

and physical functioning in the shoulder with complete tears being predictive of worse outcomes (Romeo et al., 1999). Cofield et al. (2001) found that the extent of the tear (partial vs. full or complete tears) was the most important determinant of patient strength, satisfaction, range of motion, and need for revision. Complete tears or full thickness tears are linked to recurrent tears and revision surgeries. The type of injury contributes to decisions about the type of procedure done to repair the injury.

Pain from the injury can present immediately after the injury or up to a few months postinjury (AAOS, 2007). Some of the most common physical symptoms of an acute or chronic rotator cuff injury include thinning of the muscles around the shoulder or atrophy of the muscles, weakness of the shoulder when rotating or lifting the arm, limited range of motion of the shoulder, crackling sensation when the shoulder moves in a specific direction, and pain when lifting or lowering the arm (AAOS, 2007). A rotator cuff injury can lead to frozen shoulder, which affects about 2% of the general population. A frozen shoulder is characterized by excessive stiffness and loss of motion in the shoulder. These shoulder issues can result in disability and a need for surgery (Biundo, 2008).

Rotator Cuff Repair Surgical Procedure

Despite the growing number of procedures being performed, less invasive surgical procedures have decreased the amount of time people spend in the hospital for rotator cuff surgery. There are different types of surgical procedures for RCR. A usual surgical procedure for a RCR includes three steps: removing the loose pieces of tendon, bursa or other debris that could impede the movement of the shoulder, ensuring that the rotator cuff has enough room for movement, and sewing together the edges of the tendon

to the upper arm bone (Erstad, 2008). The shoulder can require an open procedure in which a 2-3 inch incision is made to the shoulder and the tear is repaired in the described manner above from that incision. A less invasive option is arthroscopic surgery and is another option in cases when the tear is minimal (Erstad, 2008). Arthroscopy involves inserting a small tube containing a camera and light through which the surgeon can view the joint. The damage to the joint can possibly be repaired using the images from the camera and inserting instruments through a small incision with this procedure (Erstad, 2008). A mini-open surgery is still less invasive than the open procedure, and combines portions of the arthroscopy procedure while still using an incision to repair the damage to the rotator cuff. A mini-open surgery involves the surgeon splitting the deltoid muscle to gain access while using arthroscopic techniques to view the damage (Erstad, 2008).

Whether a surgical procedure is performed and the type of surgical procedure used depends on the extent of the injury including the location and size of the tear, the amount of pain the person is experiencing, and the immobility of the rotator cuff (Calvagna, 2009). A physician must assess the extent of the damage but a surgical intervention could be recommended for a variety of reasons including if previously implemented nonsurgical interventions have failed to relieve pain, the injury has just occurred and is extremely painful, the tear is on the dominant arm of the individual, or the person requires maximum strength in the injured arm (Calvagna, 2009).

Predictive Variables in Rotator Cuff Outcome Studies

Rotator cuff surgery outcome studies have found patients are generally satisfied with the outcome of open-, mini-open surgery, and arthroscopy to repair the tear (Romeo

et al., 1999; Watson & Sonnabend, 2002). Of these reviews that describe patient satisfaction, few indicators are examined that lead to poorer patient outcomes and disability. Outcomes related to disability have been extensively researched within the back and spinal pain literature. Much of the back pain literature is devoted to risk factors and various treatment options related to poorer outcomes (Block & Callewart, 1999; Hurwitz & Shekelle, 2006; LaCaille et al., 2005; McCracken & Turk, 2002). Less is known within the rotator cuff repair literature on risk factors for patient outcomes. The predictive validity of psychosocial variables has not been established within the RCR literature. Presurgical diagnosis often is not enough to predict postsurgical outcomes without examining the influence of psychosocial variables (DeBerard, Masters, Colledge, Schleusener, & Schlegel, 2001; Franklin, Haugh, Heyer, McKeefrey, & Picciano, 1994; LaCaille et al., 2005; Turner et al., 1992). Many researchers suggest that psychosocial variables are just as important or more so than physical variables in predicting surgical outcomes (Gatchel & Gardea, 1999). For example, prior low back operations, lower income at time of surgery, presence of litigation, older age, and depression are predictors of worse outcomes within lumbar fusion injured workers population (DeBerard et al., 2001; LaCaille et al., 2005). Few studies have examined psychosocial variables influence on patient selection for the RCR procedure or for predicting RCR outcomes. Many of the same predictor variables important in back surgery literature may generalize to RCR population. Rotator cuff repair outcome studies are limited to self-reports describing patient satisfaction and reports of the association between outcomes and a few demographic variables. It should be noted that the psychosocial predictive variables suggested here have not been examined for RCR in the injured workers' compensation

population. It is important to examine the predictive ability of psychosocial variables considering the unique characteristics of this population (Block & Callewart, 1999).

Demographic Variables

A few demographic variables have been examined in the rotator cuff injury literature. A study by Romeo et al. (1999) found that gender was an important predictor of varying outcomes. In Romeo et al. (1999) women were associated with poorer outcomes. Women that also had a bicep tendon rupture recovered slower than other groups (Romeo et al., 1999). Despite finding that men and women have similar symptom characteristics and pathologies, Razmjou, Davis, Jaglal, Holtby, and Richards (2009) found that women tend to report more disability due to unfulfilled expectations of recovery. Women in this study reported a reduced participation in activities, and more restrictions in terms of range of motion differences (Razmjou et al., 2009). The authors report that more studies are needed to better understand the gender differences in postoperative outcomes due to rotator cuff surgeries (Razmjou et al., 2009).

Age is another predictor that has been examined in relation to RCR outcomes. Watson and Sonnabend (2002) found that patients younger than 55 had slower recovery times, and worse outcomes than older participants. Another study found older women to be predictive of poorer outcomes after rotator cuff repair surgery (Romeo et al., 1999). A large clinical study of the prevalence of rotator cuff tears within the population found 51% of people over the age of 80 had a rotator cuff tear and in the same study 23% of all the people examined had a tear (Tempelhof et al., 1999). Fehringer, Sun, VanOeveren, Keller, and Matsen (2008) found that 22% of people over the age of 65 had some tear in

the rotator cuff and that the prevalence increased with age. More information is needed to understand the function age has on recovery after RCR.

Other demographic variables have been found to be important in the spinal pain literature that may generalize to the rotator cuff injury population include marital status, income level, level of education, and occupational variables. The findings among back/ spinal pain populations may also generalize to a rotator cuff injury working population. Several studies suggest that those with higher education are less likely to develop back pain and disability (Barnes, Smith, Gatchel & Mayer, 1989; Bigos et al., 1991; Kwon et al., 2006). This relationship may partially be explained by the idea that those with less education tend to have more physically intensive occupations than those with more education. Physically intensive occupations require heavy lifting and could increase the likelihood of an injury to the rotator cuff. Another closely related variable is a person's level of income, which may follow a similar trend. Previous research with lumbar fusion patients found that level of income presurgery was predictive of postsurgery outcomes (DeBerard et al., 2001). Similar findings have been found for patients undergoing a laminectomy with results indicating that patients with higher incomes are more satisfied postsurgery and have less severe symptomology (Katz et al., 1999). The role of marital status and childcare responsibility has been found to be related to outcomes in back disability research, although the exact relationship is still unclear (Greenough, Taylor, & Fraser, 1994; Lee, Helewa, Goldsmith, Smythe, & Stitt, 2001; Volinn, Koevering, & Loeser, 1991).

In sum, studies of RCRs have examined few demographic variables associated with outcomes. Gender and age are two demographic variables that have received some

limited attention within this literature. Other demographic variables shown to be risk factors for worse surgical outcomes in the back/spinal care literature may prove to be important to the RCR population as well.

Compensation and Litigation Variables

A large amount of research has been devoted to investigating how compensation status affects health outcomes. Poorer outcomes are documented within the literature for rotator cuff injury patients that receive compensation for their injury (Henn, Kang, Tashjian, & Green, 2008). Compensated patients often take longer to recover, have higher levels of psychological distress and report more pain when compared to noncompensated patients (Harris et al., 2005; Greenough et al., 1998; Watson et al., 2002). Compensated shoulder injury patients report symptoms and outcomes comparable to other compensated injury populations.

Koljonen and colleagues (2007) examined the association between patient outcomes and compensation status in a review of the literature. The review included all studies between 1980 to 2007 that documented participants' workers compensation status and postsurgery functional outcomes. The review concluded that compensation is a predictor of poorer functional outcomes for shoulder surgery. The review did remark that many of the studies included shoulder-specific functional measurements that the authors concluded were subjective and this could be related to the outcomes reported (Koljonen et al., 2007).

Recently, a few matched group designs have explored the relationship between compensation status and outcomes. Based on the results of comparing compensated to noncompensated shoulder surgery patients, findings support that compensated

populations report being more disabled than noncompensated one year postsurgery and overall self-report worse general health outcomes. Despite these findings, the compensated population was found to still benefit from the surgery, showing overall significant functional improvement as measured by the Western Ontario Rotator Cuff Index, the American Shoulder and Elbow Score, and the Constant-Murley score (Holtby & Razmjou, 2009; Henn et al., 2008).

The role of compensation status and litigation has been extensively studied within spinal pain literature. A large study of 18,000 patients with spinal disorders found that workers compensation status was predictive of poorer physical and mental health outcomes. Despite reporting poorer outcomes, this group was younger, had fewer co-morbid physical problems, and symptoms did not last as long as other groups (Hee et al., 2001). Compensation and litigation have been examined within the spinal fusion literature and were found to be predictive of worse outcomes. DeBerard et al. (2001) found that patients had a 376% increase in the probability of being disabled 2 years after surgery if the claim involved litigation. Vacarro, Ring, Scuderi, Cohen, and Garfin (1997) found compensation and litigation to be the best predictors of poorer outcomes for spinal fusion patients. Other spinal pain researchers have shown that compensation is associated with a number of confounding variables including educational level, income, injury severity, and heavy physical work (Burns, Sherman, Devine, Mahoney, & Pawl, 1995; Sanderson, Todd, Holt, & Getty, 1995). Hurwitz and Shekelle (2006) remarked that it becomes difficult to conclude what the role of compensation status is within the body of literature because of potential confounding variables such as income, education, and severity of the injury that have not been controlled for in previous studies. The

ability to predict outcomes using compensation and litigation variables has not been established specifically within the rotator cuff repair literature. The role of compensation and litigation as they relate to other psychosocial variables has not been studied within the rotator cuff repair population as well.

Health and Behavioral Variables

Behavioral and general health variables have been shown to be associated with increase risk of chronic disease and could be important to predicting RCR outcomes. Obesity is a multifacet chronic disease caused by a variety of environmental, behavioral, and genetic factors. Many consider obesity to be an epidemic within the United States adult population and can be linked to numerous health concerns and diseases. Despite the growing awareness within the United States of obesity and the related problems to obesity, the function of obesity as a predictor for disability following rotator cuff injury surgery has not been established. As with lower back pain, obesity may have an indirect affect on RCR outcomes by limiting activity level, and lowering physical mobility (Frymoyer, 1992; Junge, Dvorak, & Ahrens, 1995). A matched case control study found an association between increasing body mass index and the frequency of rotator cuff tears and tendonitis (Wendelboe et al., 2004). More information is needed before determining what or if there is a relationship between obesity and rotator cuff injury recovery.

Habitual cigarette smoking has received some attention as a predictor for poorer surgical outcomes for patients undergoing RCR. Mallon, Misamore, Snead, and Denton (2004) compared smokers and nonsmokers postoperative scores on a subjective pain assessment. They reported that that nonsmokers had significantly higher improvements on pain assessment and were classified based on these pain assessments as having good

or excellent outcomes as compared to smokers (Mallon et al., 2004). Smoking has also been reported as a risk factor for developing lower back pain and is cited as a predictor for poorer outcomes within the spine surgical literature (Andersen et al., 2001; Boshuizen, Verbeek, Broersen, & Weel, 1993; Goldberg, Scott, & Mayo, 2000; Rossignol, Lortie, & Ledoux, 1993). In a research study examining presurgical factors related to lumbar fusion outcomes, smoking at time of surgery was predictive of the patients' health outcomes reported 2 years later (LaCaille et al., 2005). Although like obesity, the effect this factor has upon disability status has not been examined within the rotator cuff repair literature.

Psychological Disturbance Variables

Although depression has not been examined within previous RCR literature, the link between chronic pain and depression has been researched extensively (Lindsay & Wyckoff, 1981). Lindsay and Wyckoff (1981) found that 85% of chronic pain patients meet diagnostic criteria for depression. Psychosocial variables may also be influential in prolonging a person's pain, which can lead to exaggerating one's symptoms and increased time away from work (Craig et al., 1999). If the rotator cuff tear is not an acute injury, pain in the shoulder can last for years before decreases in functioning and increased pain require a surgical intervention. Depression in chronic pain patients can lead to social isolation, catastrophizing, hypersentivity to pain, and a sedentary lifestyle. The long-term effects of chronic pain negatively impact treatment outcomes and only serve to exacerbate pain levels. Back pain researchers have stressed the importance of psychological variables in presurgical patient screenings (Block, Ohnmeiss, Guyer, Rashbaum, & Hochschuler, 2001; DeBerard et al., 2001).

Surgical History/Procedural Variables

There is some support within previous research that patients that undergo a second or more surgery for a rotator cuff injury have worse outcomes than those that only require the initial surgery (Watson & Sonnabend, 2002). Physicians have coined the term "revision" to refer to these types of repeating procedures. Watson and Sonnabend (2002) reviewed outcomes related to RCR and found that having a revision was related to worse outcomes for patients. Specifically, identifying what is meant by worse outcomes related to having a revision repair of a rotator cuff has not been studied including whether these procedures require longer recovery times or if patients report more pain after a revision.

Previous back and spinal literature suggest that having repetitive surgical procedures is related to poorer outcomes and complications (DeBerard et al., 2001; Hu, Jaglal, Axcell, & Anderson, 1997; Jönsson & Strömqvist, 1994). Failed back surgery syndrome (FBSS) is the term used to describe patients that have undergone numerous surgical procedures and continue to have persistent pain. FBSS patients usually require some type of pain management therapy instead of more invasive procedures. It is important to examine the outcomes related to revisions in RCRs to help better treat patients that may not respond to surgical repairs well.

A few studies have reported that a relationship may exist between the extent of the rotator cuff tear and the possibility of surgical complications and longer required recovery time. Romeo and colleagues (1999) found that people with rotator cuff tears larger than 5 cm reported poorer outcomes than patients with smaller tears. A larger study that included 667 open RCRs found that 87.5% of patients were satisfied with the surgical outcome (Watson & Sonnabend, 2002). Open RCRs are done when the tear is

extensive/large enough to warrant this procedure. Patients in this study reported decreases in pain levels more often than increased functional outcomes (i.e., returning to work or performing manual labor) after the RCR (Watson & Sonnabend, 2002). Another study reported complications that have been documented with the use of the open-surgical approach to repair larger tears include weakness, postoperative severe pain, and deltoid detachment (Nho et al., 2007). The conflicting results of these studies speak to the need for further investigation into the influence the extent of the injury has on patient outcomes.

Conclusions from the Literature Review

Several variables have been examined in relationship to poorer outcomes within previous research of surgical repair of rotator cuffs including demographic variables (age, gender), physiological variables (extent of injury), treatment variables (prior shoulder surgeries), and workers' compensation variables (lawyer involvement, compensation costs, history of prior claims). The few studies that have investigated predictors of lumbar spine outcomes within the Utah back surgery patient population may prove to be useful in predicting RCR outcomes within the same population (DeBerard, 1998; DeBerard et al., 2001; LaCaille et al., 2005). The predictor variables identified within these studies may also be relevant to the current study. In addition to the previous demographic, physiological, treatment, and workers' compensation variables described above, psychological variables (history of depression) and health variables (obesity, general health problems, smoking history) have some support within the spine literature as predictors of differential outcomes. These variables relevant to recovery and long-term disability within the back patient population may help rotator cuff patients as well.

The previously mentioned predictor variables influence back surgical patients' recovery time, disability status, and reports of pain (DeBerard, 1998; DeBerard et al., 2001; LaCaille et al., 2005). Arguably, these same variables could influence and generalize to rotator cuff surgical patients.

Research Purpose and Study Objectives

The three primary objectives of the current study were: (a) to describe presurgical biopsychosocial status of Utah workers that underwent rotator cuff repair surgery; (b) to examine postsurgical outcomes following RCR surgery (e.g., physical functioning, quality of life, overall health status, rates of failure, patient satisfaction, and return to work); and (c) to examine a predictive model in a sample of injured Utah workers that underwent RCR surgery.

Research Questions

This study will address the following research question related to objective 1:

1. What are the patient characteristics of this sample in terms of the presurgical psychosocial variables of interest?

2. What are the intercorrelations among the presurgical predictor variables of interest?

This study will address the following research questions related to objective 2:

1. What is the percentage of RCR surgeries in the population sample of interest?

2. What is the patient satisfaction variables percentage breakdown in the population sample of interest?

3. What percentage of the sample population did not return to work following surgery?

4. What is the percentage breakdown of good, fair, and poor outcomes (i.e., based on pain measures, return to work, usage of medication) for the patient sample?

5. What is the level of postsurgical rotator cuff surgery disability and failure and is it consistent with existing norms for RCR repair surgerical patient norms?

6. What are the mean values for overall health indicators? And how do these values compare with existing patient, nonpatient, and workers' compensation population norms?

This study will address the following research question in relation to objective 3:

1. Can a multiple variable model be used with presurgical variables to predict patient outcomes?

CHAPTER III

PROCEDURES

The current study replicates the methods used by DeBerard (1998), DeBerard et al. (2001), LaCaille et al. (2005), and more recently a lumbar fusion study (Christensen, 2010) that examined outcome variables from WCFU patients that underwent different lumbar fusion surgeries. Although the content area is different, the method and procedure used from these previous studies is still applicable. A retrospective-cohort design was used to examine presurgical and outcome variables. A retrospective cohort design is an observational method that involves both a retrospective review of presurgical variables and a prospective assessment of patient outcomes. Presurgical variables were reviewed and assessed from the patients' medical records after treatment had occurred. Patient outcomes were gathered from medical records and follow-up contact with the patient.

The current study includes demographic and patient satisfaction variables in the model relevant to both rotator cuff surgery and lumbar fusion patients and variables unique to the rotator cuff injury population. Included pre- and postsurgical variables of interest to the current model are the following: age at time of surgical procedure, time away from work, pain severity (1-10), gender, income level of the patient, education level, patients' weight category, type and severity of injury, time between injury and surgery, smoking history, history of depression or other psychological disorders, type of operation, number of rehabilitation visits, and level of pain medication usage (Figure 1). The variables included in this model are linked to poorer surgical outcomes and/or specifically poorer rotator cuff surgical outcomes.

PREDICTOR VARIABLES	OUTCOME VARIABLES
DEMOGRAPHIC VARIABLES *Age at injury *Income level Education level *Gender Marital status Child care responsibility **PHYSIOLOGICAL VARIABLES** Obesity status *Diagnosis Physical exam data Length of tear (determined during surgery) Pain severity (1-10) **TREATMENT VARIABLES** Diagnosis *Number of prior shoulder surgeries **HEALTH VARIABLES** General health problems Smoking at time of surgery Amount of pain before surgery **WORK/COMPENSATION VARIABLES** *Lawyer involvement *Total compensation costs *History of prior claims Time between date of injury and surgery Employed at time of surgery Occupation title Case manager assigned **PSYCHOLOGICAL VARIABLES** History of depression	**SIMPLE SHOULDER TEST** *Pain *Physical functioning *Range of motion **PATIENT SATISFACTION** *Global perceived effect *Current pain level on 11-point scale (VNRS) Shoulder pain following surgery Quality of life following surgery Have surgery again *Pain better or worse than expected *How satisfied if shoulder condition continued *How satisfied with WCFU **WORK VARIABLES** *Current work/disability status If not employed, why not Number of days worked past 4 weeks Number of hours a week spent working **HEALTH VARIABLES** Analgesic use (from med chart and survey) *Shoulder procedures 1-year postsurgery (from med chart and survey) Smoking history **SHORT-FORM 36 VERSION 2** *Physical health component summary score *Mental health component summary score Physical functioning Role functioning Social functioning General mental health Current health perceptions Pain

Note: *=Identifies variables that will be used in prediction analyses.

Figure 1. Predictor and outcome variables related to rotator cuff repairs.

Population and Sample

All adults insured with the Workers Compensation Fund of Utah (WCFU) that are at least 1-year post-RCR surgery were eligible for inclusion into this study. Although physicians agree recovery time depends upon many different individual factors, most

RCR patients return to normal activity and work within 6 months. Thus, 1-year postsurgery is a reasonable amount of time to expect patients to have fully recovered from surgery and to have returned to work if there are no complications. WCFU provided a signed authorization to review the patient files and to follow up with patients by telephone. From preliminary discussions with WCFU, the initial sample population size was estimated to be approximately 100-125 patients' who had undergone RCR. The WCFU database was used to identify patients that underwent a RCR surgery between the years of 1999 to 2009. After reviewing the WCFU database files, the actual sample size was determined to be less than estimated. Several patients were counted multiple times within the WCFU database files for the same procedure and other patients lacked necessary medical and demographic information making inclusion of them impossible. The results of this study are expected to generalize to United States worker's compensation patients that have undergone a RCR.

Ninety-three patients met the inclusion criteria of this study and were available for medical chart review. Of these patients, 78 were male (84%) and 15 were female (16%). In terms of ethnicity, 83 were Caucasian (89.2%), and 10 were Hispanic (10.8%). The participants ranged in age from 28 to 82 years (M = 55, SD = 10.23).

Rotator cuff injury patients typically are prescribed conservative therapies before undergoing a surgical repair. These conservative therapies include rest, acetaminophen or ibuprofen, physical therapy/range of motion exercises, and steroid injections. Acute rotator cuff injury presurgical therapies may also include ice and sling to support the effected extremity. In general, rotator cuff injuries, acute and chronic, require more than

one visit to the physician and in the case of the current sample, referral to an orthopedic surgeon.

Study Design

The current study is an observational study using a retrospective-cohort design involving two separate phases. During phase one, patient demographic and presurgical information was gathered from WCFU. This was accomplished by reviewing patient medical charts and WCFU computer database files. The second phase of the study involved a 20-25 minute follow-up telephone interview. Reviewed RCR patients were then sent a letter (see Appendix B) informing them of the nature of the study and received a follow-up telephone call.

Phase 1

Patients who met the study's specific inclusion/exclusion criteria were included in the current study. These patients' medical charts and database files at the WCFU were coded for relevant psychosocial variables. Relevant psychosocial and treatment/clinical information obtained from these files included the following categories: patient demographic, diagnosis, health status, surgical history, litigation status, and compensation costs. All patient files were coded using a Medical Chart review instrument designed by DeBerard (1998). This instrument was originally designed for a study of lumbar fusion among a similar workers' compensation population. The Medical Chart review instrument was adapted for the content area of this study (Appendix A). For example, the number of prior shoulder surgeries is an important variable to this study

and was included on the Medical Chart Review instrument. The patients' charts and files were reviewed and coded on site at the WCFU in Salt Lake City.

Phase 2

The next phase of the study was a 15 to 20 minute phone interview of each patient. The patients were initially contacted by mail with a letter describing the details of the study and assuring them of confidentiality (Appendix B). The most current contact information was obtained from their workers' compensation patient medical chart and used to contact them by mail and telephone. If the patients' most current information could not be located from their medical chart, the internet or other directory assistance was used to locate the patient. A self-addressed postcard was sent to the most current address of the patient requesting updated phone information and requesting the best time/day to contact the individual. Patients were asked to return the postcards, even if the information was correct. Patients with correct phone numbers were contacted and records of phone contact with patients were kept (Appendix C).

A phone script adapted from DeBerard (1998) was used for the initial patient contact (Appendix D). The phone script began with repeating the confidentiality and monetary incentive information presented previously to the participant in the letter of information. Verbal consent was granted from telephone contact, whether the postcard was returned or not. If the patient had not declined participation, they were asked to verbally complete the outcome measures described at detail below. Patients completed the measures during the initial phone interview or rescheduled a different time for the interview.

Materials and Instrumentation

A literature review of RCR studies was conducted to determine outcome assessments widely used and validated within this field. Inclusion criteria for the outcome assessments described below included that the validation information was accessible and outcome assessments allowed comparisons to be made with national averages and current published studies. The outcome assessments described were selected from a comprehensive list to be the most appropriate and most feasible for the current study.

Medical Chart Review Instrument

Medical charts and workers' compensation files of each patient were reviewed as described earlier in Phase 1. Rotator cuff repair patients' workers' compensation files were coded using the Medical Chart Review instrument (Appendix A). This instrument was used previously with WCFU lumbar fusion patients (e.g., DeBerard et al., 2001; LaCaille et al., 2005). Items on the Medical Chart Review included variables described in the literature review that were found to be predictive of different outcomes in the spine surgical literature and/or previous RCR research. The instrument was adapted to address the specific needs of the current RCR study (Appendix A). Specifically, prior shoulder surgeries and diagnosis of the rotator cuff tear were coded on this instrument. These items addressed issues specific to RCR patients or shoulder surgical patients. Specific back surgery items not applicable to the current population were removed from the instrument.

Telephone Survey Instruments

As described in Phase 2, a scripted phone interview (Appendix D) was conducted with patients. Rotator cuff repair outcomes were assessed with survey instruments identified in Appendix E through H and described in detail below. The RCR patient outcomes that were assessed on these instruments included patients' level of satisfaction with the WCFU and employers, any further information about surgical procedures not obtained in medical records, factors related to recovery, general mental and physical health items, and pain-related variables. The next section describes the instruments selected specifically for this post-surgical rotator cuff repair population that assisted in assessment of these various outcomes.

Simple Shoulder Test

The Simple Shoulder Test is a 12-item measure of functional disability of the shoulder. The patients were asked to answer yes or no to two questions related to pain, seven questions related to function, and three questions related to range of motion. An internal consistency Cronbach's alpha of .85 and test-retest score of .99 were reported for this measurement (Godfrey, Hamman, Lowenstein, Briggs, & Kocher, 2007).

WCFU-Satisfaction Questions

Participants were asked three close-ended questions to determine their satisfaction with their employer concerning their RCRand how WCFU handled their claim. The participant was asked to respond to the questions with one of the following answers: Yes, No, or Undecided.

Patient Satisfaction Questions

A patient's level of satisfaction with regard to the treatment is an important component in the assessment of outcomes. Questionnaires were designed to assess overall hospital and surgical care satisfaction but lacked a measure of patient satisfaction with regard to treatment (Hudak & Wright, 2000). Participants' satisfaction was assessed with four close-ended questions adapted from previous research with postsurgical outcomes (DeBerard et al., 2001; LaCaille et al., 2005). The items were adjusted to reflect language related to the rotator cuff repair procedure. The items were both positively and negatively worded and the scales range from a 3- or 7-point scale. Items ask about the participants' quality of life, current level of pain, and whether the participant was satisfied with their current condition.

Global Perceived Effect

A single item (Appendix F, item 17) was used to assess the participants' perceived level of global improvement. The Global Perceived Effect (GPE) is a subjective, single-item report of the person's level of improvement and is widely used within the pain management literature (a 6-point scale; Nath, Nath, & Pettersson, 2008; Stewart, Maher, Refshauge, Bogduk, & Nicholas, 2007; van Kleef et al., 1999; van Wijk et al., 2005). Participants were given a choice of four responses on a Likert scale to answer the question of "compared to when this episode first started, how would you describe your shoulder these days?" Responses included 1= *complete relief of pain,* 2 = *more than 50% relief,* 3 = *no change,* or 4 = *increase of pain*.

Verbal Numeric Rating Scale

The Verbal Numeric Rating Scale (VNRS) is a self-report, clinical assessment widely used to evaluate pain (Jensen, Karoly, O'Riordan, Bland, & Burns, 1989; Kaplan, Metzger, & Jablecki, 1983). The VNRS was used to evaluate the participants' perceived pain at the time of interview and an average rating of pain during the previous week (Appendix F, items 15 and 16). The participant was able to rate their pain from 0 (*none*) to 10 (*worst imaginable pain*). The test-retest reliability of these items has been found to be better than other one-item pain assessments with reported Pearson coefficient as high as .99 (Gallasch & Alexandre, 2007).

Disability Status

The participants' disability status was assessed during the phone interview by asking whether they are receiving disability for their shoulder condition (Appendix F, item 5). The participants' disability status was also assessed during the medical chart review.

Short Form Health Survey-36, Version 2

The Short Form Health Survey-36 (SF-36) Version 2 is a 36- item measure of general health functioning. The eight scales contained within the SF-36 are used to measure the following areas related to quality of life: physical functioning, role physical (or the extent to which the individuals' health interferes with daily activities), bodily pain, general health, vitality (extent to which the person has vigor and energy), social functioning, role functioning (extent to which emotional problems interfere with daily activities or work), and mental health. The eight subscales are used to compute the

Mental Health (MCS) and Physical Health (PCS) Component Summary scales (Ware & Kosinski, 2001). The summary scales are responsible for 85% of the variance in the subscales, allowing for these summary scales to be used in statistical analysis rather than the individual sub scales (Ware & Kosinski, 2001). Reliability coefficients range from .83 to .95 for the eight SF-36 subscales within the general population (Ware, Snow, Kosinski, & Gandek, 2000).

Data Analysis

The outcome data collected from both phases of the study were analyzed using the most current version available of the Statistical Software for Social Sciences (SPSS, version 19). Data collected from the medical chart review and the phone interview was coded into SPSS files for analysis. The current study analysis addressed the following three objectives: (a) describe presurgical psychosocial variables of Utah workers that received compensation from an injury and had a RCR surgery as a result of that injury; (b) examine the postsurgical RCR outcome variables associated with physical functioning, quality of life, overall health status, patient satisfaction, and return to work; and (c) examine the predictive effectiveness of presurgical variables to predict shoulder outcome variables.

Means and standard deviations were calculated tocharacterize the data in terms of presurgical psychosocial variables. Pearson correlation coefficients were used to compare pre- and postsurgical variables. Descriptive statistics and correlation coefficients will address the first and second objectives of this study. Lastly, a series of

multiple regression analysis were conducted to predict participants' disability status, and health outcomes as measured by the SF-36 summary and subscales (Figure 2).

OBJECTIVE 1: Research Questions	**OBJECTIVE 1: Data Analyses**
1. What are the patient characteristics of this sample in terms of the presurgical psychosocial variables of interest? 2. What are the intercorrelations among presurgical predictor variables of interest?	1. Will be determined by calculations of descriptive statistics for each of the eight presurgical variables. 2. A correlation matrix of the eight presurgical variables will be generated.
OBJECTIVE 2: Research Questions	**OBJECTIVE 2: Data Analyses**
3. What is the percentage breakdown for patient satisfaction variables? 4. What percentage of the subject sample is still work-disabled following surgery? 5. What is the percentage breakdown of good, fair, and poor outcomes (i.e., based upon pain reduction, return to work, physical functioning, range of motion) for the patient sample? 6. What is the level of postsurgical rotator cuff pain disability among participants and is it consistent with existing rotator cuff patient norms and previous workers' compensation populations? 7. What are the mean values for overall health indices (i.e., physical functioning, role functioning, social functioning, general mental health, current health perceptions, and pain perception) and are these consistent with existing patient, nonpatient, and worker's compensation population norms?	1. A frequency breakdown of the four patient satisfaction items will be calculated. 2. A dichotomous frequency (disabled vs. not disabled) will be calculated. 3. The frequency of total scores and percentages for responses on the SST will be calculated. 4. Percentage breakdown on the VNRS and perceived improvement on the GPE will be reported using descriptive statistics. 5. Physical and mental health composite scores will be calculated for the SF-36 and values will be compared with existing norms.
OBJECTIVE 3: Research Questions	**OBJECTIVE 3: Data Analyses**
8. Is a multiple-variable presurgical model predictive of determined patient outcome variables?	1. Predictor analyses will be achieved by examining the Pearson *r* correlation coefficients between RCR presurgical variables and the outcome measures. 2. The sample will be categorized into three outcome groups (good, fair, poor) and the predictors will be used in a multivariate discriminate functional analysis in order to predict group membership. 3. Multiple regression analyses will be used to assess the predictive efficacy of the model. Resulting regression equation statistics will be interpreted.

Figure 2. Research questions and associated analyses.

CHAPTER IV

RESULTS

The results of this research study are organized into the following sections: (a) descriptive statistics and intercorrelations of patient variables, (b) response rates and bias checks, (c) patient outcomes, (d) intercorrelation matrix of outcomes, (e) intercorrelations between patient characteristics and outcomes, and (f) prediction of outcomes. The analyses will address each of the research questions as outlined in Figure 2.

Descriptive Statistics and Intercorrelations of Patient Variables

The first objective was to describe the presurgical biopsychosocial status of injured workers that underwent a RCR surgical procedure. In order to achieve that end, descriptive statistics are reported for the entire sample (N = 93) based on information from each patient's medical charts and WCFU database files. Missing data were distributed randomly across cases. Due to the very low percentage of missing data, it was determined that subsequent coding and analysis of the missing completely at random (MCAR) data was unbiased and the amount of missing data was not significant enough to justify changing the analysis. The following patient variables have descriptive statistics reported: gender, age at time of injury, weekly income, lawyer involvement in claim, number of prior shoulder surgeries, total compensation costs incurred, and number of prior compensation claims (Table 1).

Approximately, 84% of the RCR patients were male and 16% were female. The average age of patients was 55 years old (SD = 10.23). The average weekly income of a

Table 1

Descriptive Statistics of Patient Characteristics

Patient characteristic	Frequency (N = 93)	Percentage	*M*	*SD*	Min - Max
Gender					
Male	78	83.9			
Female	15	16.1			
Age			55	10.23	28 - 82
Average weekly income			$763	$482	
Diagnosis of Injury					
Not reported	9	11.8			
Complete Rupture	12	14.0			
Contusion	4	4.3			
Dislocation	4	4.3			
Rotator Cuff Sprain	21	24.7			
Impingement	3	3.2			
Fracture	5	5.4			
Bicep Rupture/RCI	2	2.2			
Partial thickness tear	33	37.6			
Lawyer Involvement					
Yes	6	6.5			
No	87	93.5			
Shoulder surgery			0.65	.73	0 - 3
None	45	48.4			
One	37	39.8			
Two or more	11	11.8			
Total WCF costs incurred			$66,970	$78,617	
Prior WCF claims			2.05	2.86	0 - 13
None	41	44.1			
One or more	52	55.9			
Case Nurse Assigned					
Yes	28	30.1			
No	65	69.9			
Marital Status					
Single	15	16.1			
Married	56	60.2			
Divorced	22	23.7			
Number of children					
None	24	25.8			
One	47	50.5			
Two	10	10.8			
Three or more	12	12.9			
History of tobacco use[a]					
No	22	45.7			
Yes	25	54.3			
Educational level[a]					
Less than high school	0	0			
Some high school	0	0			
High school graduate	8	17.0			
Technical school	9	19.1			
Attended college	20	42.6			
College graduate	7	14.9			
Graduate Studies	3	6.4			

[a] Data collected from follow-up telephone survey, N = 47.

rotator cuff injury patient was $763 (*SD* = 482). In terms of injuries, the majority (33%) of rotator cuff injuries were not specified as to the diagnosis or extent of the injury and 11% had no reported information within the patient file as to the diagnosis of the injury. Of the patients with reported diagnosis, rotator cuff sprain was most frequently reported with 26% of patient files listing a sprain as the cause of the rotator cuff injury. Normally, a sprained shoulder accompanies a partial -to full-thickness tear of the rotator cuff muscles and requires surgery. Other injury diagnoses included injuries and damage to the rotator cuff including complete rupture of the rotator cuff (12%), fractures to the shoulder bones causing injury to rotator cuff muscles (5%), 4% of patients dislocated the shoulder joint, 4% of patients had a contusion to the shoulder that tore the rotator cuff, impingement syndrome of the rotator cuff tendons (or chronic deterioration of the rotator cuff) was diagnosed in 3%, and 2% of the population had a bicep rupture along with rotator cuff injury. Almost half or 48% of the population had not undergone a previous shoulder surgery, but 40% of the rotator cuff patients required one previous surgery on a shoulder. Eleven percent had two or three previous surgical procedures on the shoulder. None of the patients had more than three previous surgeries on the rotator cuff. Fifty-six percent of these patients had one or more prior WCF claims with the average number of prior WCF claims being 2.05 (*SD* = 2.86). Prior WCF claims ranged within the RCR patients from 0 to 13. Of the RCR claims examined, the average total expense incurred by WCF was $66,970 (*SD* = $68,617). Over half of the sample (50.5%) of patients had at least one child and approximately 25% had no children that they were responsible to care for, while the remaining quarter of the sample had more than one child under their care. Thirty percent of the sample had a case nurse manager assigned to their WCF claim, and

the majority of the sample was married (60.2%). The two patient characteristic variables of history of tobacco use and educational level were assessed during Phase 2. More patients had a history of tobacco (54.3%) and had attended college without graduating (21.5%), followed by graduating technical school, or high school graduate. Although not reported in Table 1, it should be noted that only two patients were listed as obese.

To address research question 2, an intercorrelation matrix was generated for patient variables discussed within the previous research question (Table 2). The eight patient variables presented within the matrix are the predictors that were considered for regression analyses. These predictors included gender of patient, age at time of repair, average weekly income, diagnosis of injury, lawyer involvement, presence of revision of the shoulder since the initial surgery, history of prior WCF claims, and average costs incurred by WCF for the RCR. Correlation coefficients ranged from -.25 to .46 for predictor variables included in the analysis. Seven of the correlation coefficients were significant at the alpha level of .05. Age at time of RCR was significantly positively correlated with gender of the patient ($r = .23$, $p < .05$). Meaning, older patients undergoing RCR were more likely to be women rather than men. A negative significant correlation ($r = -.25$, $p < .05$) between income at time of repair and age suggested that patients' receiving a higher wage at time of repair tended to be younger than those receiving a lower wage. A significant correlation between lawyer involvement and gender ($r = .24$, $p < .05$) suggested that women involved a lawyer in their RCR claim more often than men. Number of prior WCF claims was associated with gender ($r = -.25$, $p < .05$), age ($r = -.23$, $p < .05$), and weekly income ($r = .24$, $p < .05$) of the patient. Thus, men had more WCF claims than women; younger patients had more claims than

Table 2

Pearson Correlations Between Patient Variables

Variable	Variable 1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender	---												
2. Age	.23*	---											
3. Weekly income	-.14	-.25*	---										
4. Lawyer involvement	.24*	.13	-.19	---									
5. Injury diagnosis	-.03	-.15	.01	.01	---								
6. Number of WCF claims	-.25*	-.23*	.24*	-.09	.05	---							
7. Prior shoulder operations	-.10	-.18	.19	-.01	.19	.46**	---						
8. Total costs	-.09	-.10	-.03	.13	-.12	-.10	-.05	---					
9. Case manager	-.05	-.15	-.08	-.13	-.23*	-.08	-.06	.37**	---				
10. Marital status	-.15	-.23*	.07	-.26*	-.11	-.16	-.16	-.01	.09	---			
11. Children	-.24*	-.27*	.28**	-.08	.12	.02	.26*	-.08	-.03	-.04	---		
12. History of tobacco	-.21	-.12	-.02	.07	-.03	.16	-.12	-.13	-.12	-.01	-.01	---	
13. Education level	.21	.34*	.16	.30*	-.02	.01	-.18	-.06	-.25	-.06	-.36*	.02	---

*$p \leq .05$, **$p \leq .01$, $N = 93$.

Response Rates and Bias Checks

Ninety-three patients were identified as meeting the inclusion criteria and a medical chart review was conducted for these patients. Of the patients included in Phase 1, 47 were contacted and agreed to complete the follow-up interview via telephone (Phase 2). The follow-up response rate for these participants was 50.5%. Three patients declined to participate in Phase 2 (3.2%), and one person was deceased (1.1%). The remaining 42 patients (45.2%) could not be located due to invalid or out-of-date contact information and were considered nonresponders. To determine the effect of any possible nonresponse bias on the data, the 8 patient predictor variables were compared using univariate *t* tests and chi-square tests to predict group membership (Table 3). Each of the comparison analysis for responders to nonresponders was not significant for the predictors with the exception of age ($p = .04$). Alpha levels ranged from .04 to .51 with effect sizes SMD, Phi, or Cramer's V ranging from -.09 to .31. The mean age of responders was approximately 5 years older than nonresponders. The overall logistic model was not significant indicating that by adding the predictor variables has not significantly increased the ability to predict group membership as responder or nonresponder. Based on the resulting analysis, responders are not significantly different than nonresponders on all characteristics with the exception of age.

Patient Outcomes

In order to achieve the second objective of the study, RCR paatients' outcomes will be described in the following order: (a) patient satisfaction, (b) disability status, (c) shoulder outcome, (d) subjective pain levels, and (e) general mental and physical health

Table 3

Comparison of Respondents Versus Nonrespondents for Patient Variables[a]

Patient variables	Respondents (n = 47) Means or proportion (%)	Nonrespondents (n = 46) Means or proportion (%)	t or Chi-square P-value	Effect size[b] SMD/Phi Cramer's V
Gender				
Male	49.35	50.65		
Female	60.00	40.00	.45	-.06
Age	57.26	52.69	.04	.22
Average weekly income	735.20	802.43	.51	.07
Diagnosis of injury				
Not reported	55.55	44.44		
Complete rupture	66.67	33.33		
Contusion	25.00	75.00		
Dislocation	50.00	50.00		
Rotator cuff sprain	61.90	38.10		
Impingement	66.67	33.33		
Fracture	80.00	20.00		
Bicep rupture/RCI	50.00	50.00		
Partial thickness tear	34.38	65.62	.36	.31
Lawyer involvement				
Yes	50.00	50.00		
No	52.38	48.84	.34	-.04
Shoulder surgery			.14	.15
None	59.09	40.91		
One or more	43.75	56.25		
Total WCF costs incurred	70,423.34	48,178.70	.11	.17
Prior WCF claims			.39	-.09
None	56.10	43.90		
One or more	47.06	52.94		
Case nurse assigned			.10	.03
Yes	23.40	15.56		
No	76.60	84.44		
Marital status			.97	-.04
Single	14.89	17.78		
Married	61.70	60.00		
Divorced	23.40	22.22		
Number of children				
None	23.40	28.89	.26	.01
One or more	76.60	71.11		

[a] Omnibus chi-square = 14.15 (df = 11), p = .225, [b] Effect sizes based upon univariate analyses.

function. The results of this section will address research questions 3 to 7 with specific results being addressed within the corresponding section.

Patient Satisfaction

Research question 3 refers to the level of patient satisfaction after the RCR surgery. Patient satisfaction was assessed during the collection of information from participants during the telephone survey. Participants were asked about their quality of life after the surgery, a retrospective assessment of whether they would repeat the procedure, whether they were better or worse than expected, and their level of satisfaction with the outcome. The percentages and frequencies for the satisfaction variables are listed in Table 4. The first satisfaction question asked if the participants' quality of life was better or worse than expected as a result of the surgery. Participant responses to this item and percentage of participants' that responded to each category included: a great improvement (39.1%), a moderate improvement (17%), a little improvement (6.3%), no change (14.9%), a little worse (12.8%), moderately worse (2.1%), and much worse (14.9%). The next satisfaction item was asked to determine whether the participant would undergo the same procedure again, given the patients' current outcome. The majority of participants (85.1%) responded "yes" that they would have the procedure done again, 10.6% said "no," and 4.3% of participants were "undecided." Participants were next asked if currently they were better or worse than expected. Most participants responded that they were much better or somewhat better than they expected but almost the same percentage of participants responded that they were somewhat or much worse than expected. No participants responded that they had no expectations and 14.9% responded that their expectations were met. Lastly,

Table 4

Patient Satisfaction with Outcomes of Rotator Cuff Repair Surgery

Outcome category	Frequency (n = 47)	Percentage
Quality of life		
Great improvement	15	31.9
Moderate improvement	8	17.0
Little improvement	3	6.3
No change	7	14.9
A little worse	6	12.8
Moderately worse	1	2.1
Much worse	7	14.9
Retrospectively, would choose to have the repair done again		
Yes	40	85.1
No	5	10.6
Undecided	2	4.3
Shoulder pain now		
Much better	13	27.7
Somewhat better	13	27.7
What I expected	7	14.9
Somewhat worse	4	8.5
Much worse	10	21.3
No expectation	0	0.0
Satisfaction with shoulder condition		
Extremely dissatisfied	9	19.1
Very dissatisfied	3	6.3
Somewhat dissatisfied	3	6.3
Neutral	6	12.8
Somewhat satisfied	6	12.8
Very satisfied	16	34.0
Extremely satisfied	4	8.5

participants were asked whether they were satisfied with the condition of their shoulder. Most participants responded that they were very satisfied as to their condition, but 31.7% of participants stated that they were either extremely, very, or somewhat dissatisfied as to the condition of their shoulder.

Disability Status

The participants' work-related disability status after the RCR was assessed during the telephone interview follow-up survey. If participants responded to the question of whether they were currently working with a "no," they were then asked as to why they were not working. Responses to this item included a category to determine their disability status. Of the participants surveyed, approximately 30% were not working and were considered to be totally disabled as a result of their shoulder condition (see Table 5).

Shoulder Outcome

The functional physical impairment of the shoulder was determined by using the self-report measurement Simple Shoulder Test (SST). Participants were asked to respond with a dichotomous "yes" or "no" to 12-items in order to determine whether their shoulder would restrict their activities (see Table 6). Participants responded with a "yes" if the activity caused no pain or rarely caused pain, or "no" if the activity caused the shoulder to hurt always, often, or sometimes. If the activity was not something they would normally do, they were asked to imagine if they were to do the activity. A person with full physical functioning of the shoulder would respond in the affirmative to all 12 items.

Table 5

Disability Status Outcome

Outcome	Frequency	Percentage
Total disability		
Yes	14	29.8
No	33	70.2

Note. Based on *n* of 47 at follow-up.

Over 70% of participants could perform 5 of the 12 items. These five items were activities that required little functioning within the shoulder joint such as resting the arm by their side or lifting a 1-pound weight to shoulder height with the arm straight. Over half of the participants were able to perform 10 of the 12 items with the additional items asking whether the participant could perform activities requiring more functioning within shoulder such as tossing a ball underhand or carrying 20 pounds by their side. Of those surveyed, 57.4% answered "yes" when asked as to whether their shoulder would allow them to work full time at a regular job. Thirty-four percent of the participants felt that they could throw a ball overhand with their shoulder in the current condition.

Previous literature examining the validity of the SST has shown that following surgery a 3-point difference is clinically significant (Roy, MacDermid, Faber, Drosdowech, & Athwal, 2010). Based on these recommendations, outcomes can be categorized as *good* (score of 10 to 12), *fair* (score of 7 to 9), or *poor* (score of 6 or less) physical shoulder functioning. Almost half or 44.7% of patients surveyed reported good shoulder functioning with 19.1% reporting fair outcomes, and 36.2% of patients reporting poor shoulder functioning (Table 7).

Table 6

Physical Functioning as Assessed by the Simple Shoulder Test

Simple Shoulder Test Item	Frequency (*n* = 47)	Percentage
Arm at rest	37	78.7
Sleep comfortably	26	55.3
Tuck in shirt	34	72.3
Hand behind head	33	70.2
Coin on shelf	38	80.9
Lift 1 pound	35	74.5
Lift 8 pounds	26	55.3
Carry 20 pounds	30	63.8
Toss underhand	31	66
Throw overhand	16	34
Wash opposite shoulder	30	63.8
Work full time	27	57.4

Table 7

Percentage of Simple Shoulder Test Good, Fair, and Poor Outcomes

Outcome	Frequency	Percentage
Poor	17	36.2
Fair	9	19.1
Good	21	44.7

Note. Based on *n* of 47 at follow-up.

The current sample of patients covered by UWCF was compared to two different samples of rotator cuff injuries (see Figure 3). These samples included both rotator cuff injury patients covered by workers' compensation and not covered that were used to assess the validity and reliability of the SST (Godfrey et al., 2007). The mean scores for the current sample more closely resembled the workers' comparison sample than the patients not covered by workers' compensation. Current patients' SST scores resembled the level of physical functioning and shoulder disability that workers' compensation rotator cuff injury populations.

Subject Levels of Pain and Methods of Pain Management

In addition to the survey instruments developed by DeBerard (1998) that were used to assess patient outcomes, additional patient information was collected during the medical chart review and telephone survey instrument. The additional information gathered included indices to assess patients' levels of pain and the method by which patients manage their pain. The first measurement item was the Global Perceived Effect (GPE), a single-item question used in previous studies of pain patients, designed to assess a patient's overall pain as compared to when the first episode started. Patients were asked "compared to when this episode first started, how would you describe your shoulder these days?" and the item responses included: complete relief of pain, more than 50% pain relief, no change in the level of pain, and the pain has increased. Most patients (48.9%) responded that they had more than 50% pain relief since the initial episode and 42.6% responding that they have experienced a complete relief of pain. One patient

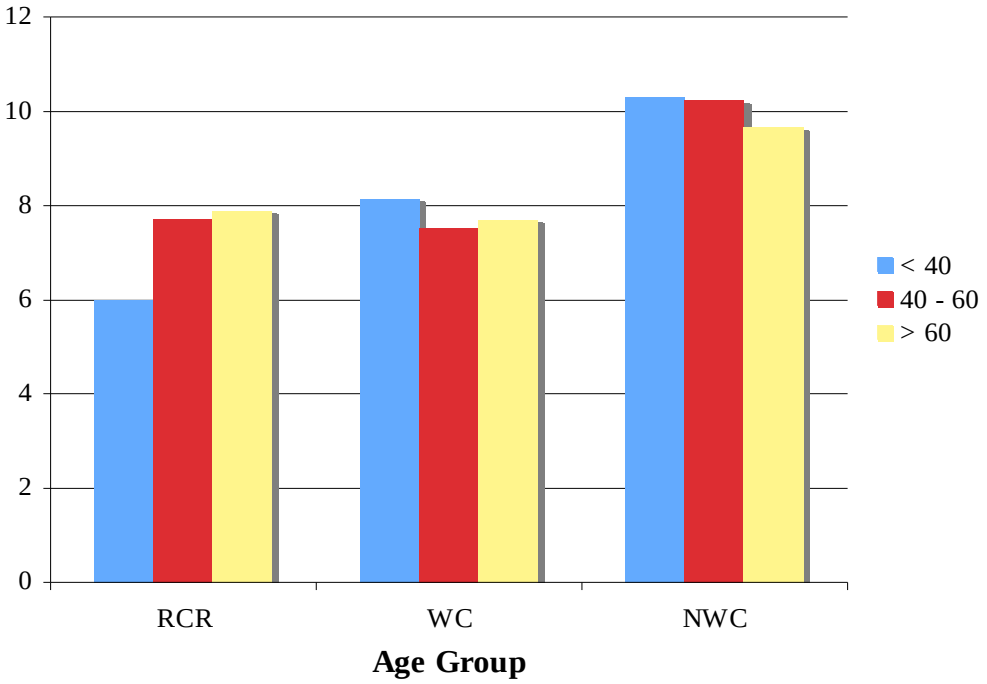

Figure 3. Simple Shoulder Test scores by workers' compensation status and age group.
RCR- SST mean scores after rotator cuff repair, *n* = 47.
WC- Comparison sample of patients covered by Workers' Compensation, *n* = 59 (Godfrey et al., 2007).
NWC- Comparison sample of patients not covered by Workers' Compensation, *n* = 343, (Godfrey et al., 2007).

stated that there was no change in the level of pain, and three patients stated that the pain had increased in their shoulder.

Patient level of pain was also measured with the Verbal Numeric Rating Scale (VNRS). Patients were asked to rate both their current level of pain and an average level of pain in their shoulder on a scale from 0, indicating no pain to 10, the worst pain imaginable (see Table 8). The large majority of patients (63.8%) described their pain as being within the 0 to 3. Below 3 was considered a mild amount of pain. The remaining respondents described their pain as either moderate (range of 4 to 7) or severe (range of 8 to 10). Twenty-five percent of patients described their pain as moderate and 10.6%

Table 8

Global Perceived Effect, Verbal Numeric Rating Scale, and Additional Pain Procedure Outcomes

Outcome measure	Frequency	Percentage
Global perceived effect[a]		
Complete relief of pain	20	42.6
More than 50% pain relief	23	48.9
No change in the level of pain	1	2.1
The pain has increased	3	6.4
Verbal Numeric Rating Scale (VNRS)[b]		
Mild pain (0-3)	30	63.8
Moderate pain (4-7)	12	25.5
Severe pain (8-10)	5	10.6
Additional pain procedures[c]		
None	29	61.7
Procedure scheduled	5	10.6
Procedure performed	13	27.7

[a] Survey item: "Compared to when this episode first started, how would you describe your shoulder pain these days?"; *n* of 47 at follow-up.
[b] Self-report of current pain rating on a 0-10 scale for *n* of 47 patients at the time of follow-up.
[c] Subsequent surgical intervention procedures received or scheduled to be done since the initial shoulder repair by *n* of 47 patients based on medical chart review and interview.

described their pain as severe. Lastly, patients were asked as to whether they have required any subsequent surgical procedure for the affected shoulder. The rationale for collection of these data were patients had additional surgical procedures likely experienced poorer outcomes than patients that did not require additional pain intervention procedures. If the patient responded in the affirmative, the patient was asked as to the type of procedure performed. Sixty-one percent of the patients did not require any additional shoulder surgeries after their initial procedure. Of the remaining patients surveyed, 10.6% of these patients had a surgery scheduled and 27.7% stated that they had additional surgical procedures on the affected shoulder, which indicates these patients did not recover as well as the patients requiring no extra procedures.

General Physical and Mental Health Functioning

To address research question 7, general physical and mental health functioning was assessed using the SF-36v.2 (Ware et al., 2000). The SF-36v.2 consists of eight subscales and a composite score for a person's general physical and mental health. The eight subscales include: physical functioning (PF), role-physical functioning (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional functioning (RE), and mental health (MH). The two summary scales are the PCS and MCS. Scores for all subscales and summary scales were calculated and compared to two different normative samples (Gartsman, Khan, & Hammerman, 1998; Ware et al., 2000). General population normative data were drawn from the general U.S. adult population (N = 6742) and from a smaller RCR study (N = 73). Norm-based scoring was used with the RCR sample based on recommendations given by the SF-36v.2 developers (Table 9). General population mean is 50 with a standard deviation of 10. Interestingly, the RCR sample (N = 47) mean scores were higher on all of the subscales with the exception of vitality and the physical and mental summary scale scores. In comparing the two groups, the standard mean difference effect sizes were quite large ranging from -.07 to 2.5. The largest effect sizes were on the mental and social health scales of social functioning and role emotional functioning. Although, patients mean physical and mental health scale scores also had high effect sizes when compared to the general population. Rotator cuff repair patients' scores more closely resembled the comparison RCR group than the general population, but reported mean scores were lower on all scales than the comparison RCR group. Regarding the RCR samples, the calculated effect sizes ranged from -1.0 to -.2. Here the largest effect sizes differences were on the scales of vitality,

Table 9

SF-36(v.2) Multidimensional Health Outcomes and Comparisons

SF-36 subscale	WC RCR sample *M* (*SD*)	General population[a] *M* (*SD*)	General population effect size[b]	RCR *M* (*SD*)[c]	RCR sample effect size[b]
Physical functioning	66.1 (21.5)	50.0 (10.0)	1.6	76.6 (27.1)	-0.4
Role functioning	64.2 (28.8)	50.0 (10.0)	1.3	75.7 (40.4)	-0.3
Pain severity	55.8 (24.8)	50.0 (10.0)	.6	68.2 (24.1)	-0.5
General health	61.9 (21.6)	50.0 (10.0)	1.2	72.4 (21.8)	-0.5
Vitality	44.9 (21.8)	50.0 (10.0)	-0.5	62.8 (18.4)	-1.0
Social functioning	74.7 (31.5)	50.0 (10.0)	2.5	84.0 (25.5)	-0.4
Role-emotional functioning	75.0 (28.8)	50.0 (10.0)	2.5	82.4 (34.3)	-0.2
Mental health functioning	66.0 (26.9)	50.0 (10.0)	1.6	78.2 (19.3)	-0.6
Physical component summary	43.3 (9.4)	50.0 (10.0)	-0.7	46.6 (10.8)	-0.3
Mental component summary	45.6 (14.5)	50.0 (10.0)	-0.4	52.6 (9.4)	-0.7

Note. Scores range from 0-100. A high score indicates better health status.
[a] General U.S. adult population; *N* = 6742 (Ware et al., 2000).
[b] Standardized mean difference effect size = difference between means divided by normative sample *SD.*
[c] Norms for sample of repair of full-thickness tears of rotator cuff (in last two years); SF-36 version 1, *N* = 73 (Gartsman et al., 1998).

mental health, and the mental health summary score. A comparison of the current sample to both the general population and the previous RCR population can be observed in Figure 3.

As mentioned earlier, the eight subscale scores can be aggregated into the two summary scale scores of PCS and MCS. These summary scores are indicators of a person's general health as measured by physical and psychosocial factors that contribute to that health. The reported PCS and MCS values were lower than both comparison groups. As expected, physical functioning was more similar to the RCR than the general population but the mental health summary score resembled the general population. The difference between the effect sizes on each comparison is modest. The effect sizes for the PCS score were .7 and .3 for the general population, and RCR sample and MCS effect sizes were .4 and .7, respectively. Meaning, injured workers report worse general physical and mental health than both the general population and other RCR samples.

Intercorrelations of Outcomes

The relationships among the outcome variables were examined by calculating Pearson product-moment correlations on 17 different variables. The correlations between the following outcome variables were organized into a matrix in Table 10: quality of life and satisfaction with outcome (3 items), total disability (yes/no), GPE (one item), whether additional surgical procedures performed postinitial surgery, Short Form-36 v.2 Health Survey (summary and subscale scores), and the SST summary score. In order to improve interpretations of the correlations between variables, 4 of the 17 variables were

Table 10

Pearson Correlations Between Outcome Variables

	Variable																
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	---																
2	.24	---															
3	.55[1]	.21	---														
4	.59[1]	.13	.71[1]	---													
5	.34[*]	.25	.51[1]	.58[1]	---												
6	.27	.05	.73[1]	.35[*]	.11	---											
7	.21	.25	.57[1]	.48[1]	.52[1]	.43[1]	---										
8	.36[*]	.03	.62[1]	.69[1]	.47[1]	.41[1]	.67[1]	---									
9	.57[1]	.15	.66[1]	.69[1]	.68[1]	.37[*]	.58[1]	.64[1]	---								
10	.31[*]	.16	.37[*]	.36[*]	.28	.27	.60[1]	.66[1]	.49[1]	---							
11	.40[1]	.29	.62[1]	.67[1]	.23	.48[1]	.71[1]	.77[1]	.48[1]	.58[1]	---						
12	.23	.15	.46[1]	.68[1]	.33[*]	.34[*]	.50[1]	.66[1]	.29[*]	.48[1]	.60[1]	---					
13	.42[1]	.04	.51[1]	.69[1]	.39[1]	.23	.22	.63[1]	.48[1]	.39[1]	.39[1]	.58[1]	---				
14	.61[1]	.10	.59[1]	.85[1]	.25	.37[1]	.42[1]	.65[1]	.54[1]	.45[1]	.71[1]	.68[1]	.75[1]	---			
15	.20	.18	.49[1]	.35[*]	.53[1]	.37[*]	.87[1]	.71[1]	.68[1]	.71[1]	.61[1]	.32[*]	.09	.21	---		
16	.50[1]	.10	.54[1]	.82[1]	.24	.32[*]	.30[*]	.64[1]	.40[1]	.41[1]	.63[1]	.78[1]	.87[*]	.94[*]	.09	---	
17	.43[1]	.27	.68[1]	.66[1]	.72[1]	.32[1]	.48[1]	.55[*]	.68[*]	.12	.43[1]	.30[1]	.49[*]	.49[*]	.40[*]	.43[*]	---

Note. 1=quality of life change[a]; 2=retrospectively, would repeat rotator cuff repair; 3=satisfaction with current shoulder condition; 4=disability status (yes/no)[a]; 5=global perceived effect[a]; 6=additional surgical procedures post-first rotator cuff repair[a]; 7=SF-36: Physical Functioning; 8= SF-36: Role Physical Functioning; 9= SF-36: Bodily Pain; 10= SF-36: General Health; 11= SF-36: Vitality; 12= SF-36: Social Functioning; 13= SF-36: Role Emotional; 14= SF-36: Mental Health; 15= SF-36: Physical Component Summary; 16= SF-36: Mental Component Summary, 17= Simple Shoulder Test.

[a] Reverse coded so higher scores reflect better functioning/outcome.

[*] $p \leq .05$; $N = 47$.

recoded so that higher correlations reflect better outcomes. Overall, correlations ranged from .03 to .94 and 104 out of 136 correlations were significant at the $p < .05$.

One correlation coefficient was found to be statistically significant among the three patient satisfaction items ($r = .54$). That is, a person that indicated an increase in their quality of life after their surgery also reported that they were satisfied with the current condition of their shoulder. Interestingly, the item asking for a retrospective perspective of whether they would repeat the procedure was not significant with any other item. The remaining two patient satisfaction items significantly correlated with 24 of the outcome variables with intercorrelations that ranged from .31 to .73 ($p < .05$). For example, if a patient reported that they were satisfied with the current condition of their shoulder they were also more likely to report better outcomes on all other outcome variables including better general physical and mental health functioning, less likely to be disabled, and have increased shoulder function.

Disability status correlated with all of the other outcome variables (with the exception of the retrospective item) and correlations ranged from $r = .35$ to .85 ($p < .05$). Meaning, patients that indicated that they were not disabled were likely to have better outcomes than those that were disabled. As expected, the global perceived effect item that measures whether a person is continuing to experience pain was significantly correlated with physical functioning measures, including SF-36v.2 scales, disability status, and the shoulder assessment with coefficients that ranged from .33 to .72.

Correlation coefficients ranged from .32 to .73 for the item indicating whether a patient required additional surgical procedures. This item correlated with only one of the

patient satisfaction items, the shoulder functioning assessment and all the SF-36v.2 items with the exception of role-emotional functioning and general health. Similarly, the PCS correlated with only one patient satisfaction item, the shoulder functioning assessment, and all SF-36v.2 subscales except role-emotional functioning and the mental health summary score (r = .32 to .87). In other words, patients reported physical health was not associated with better or worse mental health functioning. The largest correlation coefficients were between the MCS and PCS scores and subscales of the SF-36v.2. Eighty-two of the correlation coefficients for the SF-36v.2 subscales and summary scores were statistically significant with a magnitude that ranged from .29 to .94.

In examining the entire matrix, the intercorrelations presented reflect some significant overlap among many of the outcome variables, which is expected as many of these constructs are similar. The correlations were not so high as to conclude that variables were redundantly assessing the same constructs.

Correlations Between Patient Characteristics and Outcomes

To fully address research question 8, the relationships between patient characteristics and outcome variables will be reported. A correlation matrix was generated in the same manner previously described above with Pearson product-moment correlations. Table 11 is a correlation matrix of 8 predictor variables (gender, age, weekly income, lawyer involvement, diagnosis code of the injury, revision shoulder operation, and number of prior WCFU claims) and the outcome variables (SST score, disability status, SF-36v.2 subscales, and summary scale scores).

Table 11

Correlations of Pre-Rotator Cuff Repair Variables with Outcome Variables

	Outcome variables		SF-36 subscale[a]									
Patient variable	Physical functioning[a]	Disability status	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Gender of patient	-.03	.08	.01	.08	.02	.20	.00	.16	.24	.11	-.01	.18
Age at time of RCR	.21*	.25	-.03	.21	.03	.21	.08	.27	.35*	.25	-.04	.33*
Weekly income	.04	.12	.22	.20	.21	-.04	.14	-.01	.04	.02	.22	-.01
Lawyer involvement	.11	.17	.13	.08	-.05	-.04	.09	.18	.13	.09	-.01	.13
Injury diagnosis	-.10	.15	.10	.13	.34*	.17	.10	-.02	.26	.15	.14	.14
Number of WCF claims	-.04	.26	.03	.07	-.03	-.22	.22	.11	.28	.31*	-.21	.33*
Shoulder operation	-.15	-.07	-.10	-.19	-.04	-.16	-.11	-.11	.01	-.06	-.15	-.04
Total WCF costs	.00	-.31*	-.11	-.35*	-.22	-.10	-.12	-.45*	-.54*	-.23	-.10	-.40*
Case Manager	-.02	-.14	-.36*	-.42**	-.30*	-.34*	-.16	-.32*	-.35*	-.16	-.37	-.22
Marital Status	.01	-.21	-.05	-.20	-.08	-.13	-.07	-.12	-.18	-.10	-.08	-.13
Number of children	-.10	-.22	-.17	-.32*	-.10	-.39**	-.28	-.39**	-.30*	-.32*	-.15	-.37*
History of tobacco	.11	.39*	.15	.23	.15	.12	.36*	.32*	.15	.37*	.07	.34*
Educational level	.20	.27	.25	.42**	.02	.35*	.28	.55**	.40**	.28	.18	.41**

Note. PF = Physical Functioning; RP = Role-Physical; BP = Bodily Pain; GH = General Health; VT = Vitality; SF = Social Functioning; RE = Role-Emotional; MH = Mental Health; PCS = Physical Component Summary; MCS = Mental Component Summary

[a] Higher scores equate to better outcomes/functioning.

* $p \leq .05$.

In comparing the patient characteristics to outcome variables, 12 out of 96 correlations were statistically significant at the $p < .05$ level ranging in value from -.54 to .55 (see Table 11). Patient characteristics were compared to scores on the SST, which is an indicator of shoulder functioning. Age of patients at time of surgery was significantly related to scores on the SST ($r = .21$). Meaning, the older a patient was at time of surgery the more likely they were to report increased physical functioning in the shoulder. Disability status was negatively correlated ($r = -.31$) with the total costs of the RCR and correlated with history of tobacco use ($r = .39$). Thus, patients that were disabled also had higher total costs associated with their WCF claims and were more likely to have used tobacco.

The interrelationships among patient variables and SF-36v.2 subscales and summary scales were examined and 9 out of 80 correlations were found to be statistically significant. The significant correlations ranged in magnitude from -.54 to .35. Of the SF-36v.2 subscales examined, role-emotional functioning had the highest and lowest correlation coefficient reported with age and total costs incurred, respectively. The role-emotional subscale contributes to the overall mental health summary score and measures a person's role limitations due to emotional problems. Older patients reported better scores on the role-emotional subscale but those with higher WCF claims reported more limitations due to emotional problems. Patients' bodily pain subscale score correlated with injury diagnosis, which indicated that diagnosis such as partial thickness tear, RCT with co-morbidity of a bicep rupture, fracture, or impingement reported less bodily pain than those with a complete rupture, contusion, or dislocation. The mental health subscale was positively correlated ($r = .31$) with the total number of WCF claims. Patients that

reported higher functioning or better mental health subscale had more WCF claims than those patients with less or no previous WCF claims. In examining the relationships between patient variables and the summary scale scores, the MCS score was correlated with age, number of WCF claims, and total WCF costs incurred with correlation coefficients of .33, .33, and -.40, respectively. In other words, older patients and those with more WCF claims reported higher overall mental health functioning but those with higher total costs reported worse mental health functioning. Overall, the total WCF costs incurred, case manager assigned, and number of child responsibility variables had more significant correlations than the other variables examined. Total WCF costs had correlation coefficients of r = -.31, -.35, -.45, -.54, and -.40 for disability status, role-physical and emotional, social functioning, and the mental health summary scale. Thus, patients that had higher total costs for their WCF claim were disabled, reported more limitations due to physical and mental problems, and functioned less socially. Case nurse manager assigned was significant with 6 of the 8 SF-36 subscales, ranging from r = -.42 to -.30. Meaning, when a case manager was assigned to a claim, those patients reported worse outcomes on SF-36 subscales than those without a case manager. Number of children was significant with 5 of the subscales and the general health summary score. Patients with more children reported worse outcomes than those with no or less children. Finally, educational level was highly statistically correlated with the SF-36 subscales of role-physical, role-emotional, social emotional, general health and the mental health summary score with correlation coefficients of r = .42, .35, .55, .40, .41; respectively. Patients with more education reported better mental health functioning than those with less education.

Multivariate Prediction of Outcomes

To address the final objective of the current study, the effectiveness of presurgical patient variables to predict postsurgical outcomes was examined. The results of this analysis will be presented in two sections. First, the ability to predict disability status using a logistic regression model using the biopsychosocial pre-RCR surgical variables will be examined. The second segment will involve utilizing simultaneous entry multiple regression models to predict SST outcomes, and SF-36v.2 subscales and summary component scores.

The logistic and multiple regression models will evaluate four variables utility in predicting outcomes after rotator cuff repairs among this workers' compensation sample. Originally, the goal was to use more variables in the process of predicting various outcomes. It became clear that fewer variables would need to be evaluated due to the rate of response of participants during Phase 2. Multiple linear regression is used to determine if an association exists between two or more predictors (covariates) and an outcome. For the current study, regression analyses were conducted to examine the relationship between each disability outcome and predictors or covariates selected from previous research findings determined to be important to the selected outcome. Power of a statistical model is determined by the effect of the treatment and the probability of making a type 1 error. The available sample size was limited to those patients covered by WCFU that had undergone a RCR and that could be contacted during Phase 2.

It was important to determine a sample size that will generate sufficient statistical power but not be so large as to strain the resources available. In calculating a priori sample size, the estimate of effect size was $p = 0.30$ based on effect sizes reported by

previous WCFU studies on health outcomes (Christensen, 2010). The power analysis conducted maintained a significance alpha level of $p < .05$ to decrease the probability of a Type 1 error. The power of the test (1 - β) or probability of accepting the null hypothesis when in fact it is false, for the current study the power was set to a β = .20. Meaning, the power of the test (1 - β) will be 0.80 or the probability of correctly rejecting the null hypothesis will be 80%. Based on these parameters, sample size calculation revealed that 45 patients were needed if four predictors were used in the model or 49 if five predictors were analyzed. Consequently, the resulting sample size of 47 made it necessary to reduce the predictors to four. The following predictor variables included in the analysis: gender, age, number of WCF claims, and presence of additional shoulder surgeries. These variables were described in the literature review. The predictors were selected for inclusion based on previous workers' compensation population studies with back pain patients, and from the information provided in both the current analysis and previous RCR literature.

Prediction of Disability Status

Disability status was assessed using a dichotomous (yes/no) item thus the resulting distribution is binominal, not normally distributed. Logistic regression analysis is most appropriate for prediction of outcomes when the dependent variable has a binominal distribution. A logistic regression will allow for better clinical interpretations of the resulting analysis and is commonly used to assess risk factors associated with development of specific diseases or illnesses (Hosmer & Lemeshow, 2000).

As shown in Table 12, the overall percentage of patients that disability status was correctly predicted at follow-up was 71.7%, with specific hit rate of 28.6% for disabled

Table 12

Logistic Regression Model: Disability Classification [a]

Observed	Predicted		% Correct
	Disabled	Not disabled	
Disabled	4	10	28.6
Not disabled	3	29	90.6
Overall correctly predicted			71.7

[a] The cut-value for group membership is .50.

and 90.6% for nondisabled patients. The predictive efficacy of the model for disabled patients was similar to the base rate of 29.8% (14/47), thus there was no improvement in prediction by the four-variable model. The four-variable model did improve upon the base rate of 68.1% (32/47) for nondisabled patients by 22.5%. The overall logistic model examined was statistically significant (chi-square = 10.97, $df = 4$, $p \leq .05$), which indicates that the entire four-variable model led to a better prediction of disability status than what would be expected from observed base rates alone. Based on the overall significance of the model, further examination into each individual variables contribution to the model is warranted.

Of the Wald values reported in Table 13, a patient's number of WCF claims was the only significant predictor of disability status ($p < .05$). The remaining predictor variables of gender, age at time of RCR, and presence of previous shoulder surgery were not significant in predicting disability status. The logistic coefficients provide the log odds and odds of whether a patient will be disabled given an individual predictor variable. The logistic coefficient (β) allows for interpretation of log odds and the estimated logistic coefficient (Exp β) provides a measure of the odds. The logistic

Table 13

Logistic Regression Equation Predicting Disability Status with Four Pre-Rotator Cuff Repair Variables as Predictors[a]

Variable	β	Wald	*P*	Exp (β)	95% CI
Gender	-.78	.66	.41	.45	.06 – 3.01
Age	-.06	2.62	.10	.94	.86 – 1.01
Shoulder surgery	1.25	1.90	.16	3.51	.58 – 20.91
Number of WCF claims	-.86	3.93	.04	.41	.17 – .99
Constant	2.91	1.22		18.45	

[a] Omnibus chi-square = 10.97, df = 4, $p \leq .05$.

coefficients can be understood to indicate how likely (or unlikely) a patient is to be disabled given one unit of change in the predictor variable. For example, a value greater than 1 indicates an increase in the odds a person will be disabled and less than 1 indicates a decrease in the odds that a person will be disabled when interpreting the estimated logistic regression coefficient. If the value of the coefficient is 1, no relationship exists between the variables. For ease in interpretation, the estimated logistic coefficients will be examined. The presence of a revision shoulder surgery had the highest estimated logistic coefficient (3.51) with the remaining three variables having coefficients that were lower in value (.41 to .94). Therefore if all other variables remained constant in the model, patients that had a revision shoulder surgery were three times more likely to be disabled than those that did not have any shoulder surgical history.

Next, the same four variables: gender, age, revision shoulder surgery, and number of WCF claims were used in a regression analysis to determine the effectiveness of these variables in predicting shoulder functioning as measured by the SST. A linear regression

was used in the analysis because unlike disability status, SST scores are continuous variables, and thus normally distributed. A simultaneous-entry multiple regression was used to analyze the four-variable model. In multiple regression, the Beta weights indicate the amount of expected change in the dependent variable given a unit change in the predictor variable, controlling for the other predictor variables (Stevens, 1996). For the current model, the Beta weights for predictors cannot be directly compared so it becomes helpful to interpret the standardized coefficients. The four-variable model was not statistically significant, $F = 1.495$, $p = .211$, in predicting SST total score (see Table 14).

The remaining analyses in this chapter are using a simultaneous-entry multiple regression of the four-variable model to determine its ability to predict general mental and physical health outcomes. Patients' multidimensional physical and mental health outcomes were assessed via the SF-36v.2 eight subscales and two summary scales. The

Table 14

Simultaneous-Entry Multiple Regression Model Predicting the SST Total Score[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	-1.034	1.386	-0.081	0.457
Age	.095	0.050	0.205	0.061
Prior shoulder surgery	-1.409	1.129	-0.148	0.216
Number of WCF claims	.073	.200	0.043	0.717
Constant	1.889	3.519		

[a] Model summary: $p = .21$, $R = .255$, $R^2 = .065$, adjusted $R^2 = .022$.

SF-36v.2 subscales and summary scales are continuous variables, thus data will be analyzed using linear regression. The physical component scale score is based on patients' responses to the physical functioning, role-physical, bodily pain, and general health items. Beginning with the PCS summary score, the regression model summary was not statistically significant at the $p < .05$. The predictors of age, gender, presence of revision shoulder surgery, and previous WCF claims did not account for a significant amount of variance in patients' PCS scores (see Table 15). The subscales of the PCS: physical functioning, role-physical, bodily pain, and general health were examined for statistical significance. As anticipated, the subscale regression models were not significant in relation to the predictor variables (see Table 16-19). These findings indicate that only a trivial amount of the total variance in PF, RP, BP, and GH was explained by the predictor variables. None of the individual predictors in the four-variable model reached statistical significance an alpha level of .05.

The regression model summary for the MCS SF-36v.2 score was statistically significant, $F = 4.339$, $p \leq .005$, with the resulting R^2 of .297. In other words, nearly 30% of the total variance in MCS score was accounted for by the predictor variables. Table 20 shows that the beta weights associated with age ($\beta = .310$, $p = .026$) and number of previous WCF claims ($\beta = .444$, $p = .003$) were the only predictors that reached statistical significance. Indicating, that these are the most influential predictors in the model. Gender had a trend for significance but did not reach the set alpha level ($p = .090$). These findings can be interpreted to mean the higher the number of WCF claims, and older age were most predictive of better general mental health (i.e., higher MCS scores) than younger patients and those with fewer claims.

Table 15

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Physical Component Summary Score[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	-0.832	3.753	-0.035	0.826
Age	-0.062	0.141	-0.068	0.663
Revision shoulder surgery	-1.971	3.038	-0.104	0.520
Number of WCF claims	-0.726	0.619	-0.191	0.248
Constant	51.904	10.081		

[a] Model summary: $p = .639$, $R = .242$, $R^2 = .058$, adjusted $R^2 = -.033$.

Table 16

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Physical Functioning Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	1.694	8.738	0.031	0.847
Age	-0.097	0.327	-0.470	0.768
Revision shoulder surgery	-4.579	7.072	-0.106	0.521
Number of WCF claims	0.535	1.440	0.062	0.712
Constant	75.506	23.470		

[a] Model summary: $p = .972$, $R = .111$, $R^2 = .012$, adjusted $R^2 = -.084$.

Table 17

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Role-Physical Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	6.895	11.072	0.097	0.537
Age	0.487	0.415	0.179	0.247
Revision shoulder surgery	-10.696	8.961	-0.188	0.240
Number of WCF claims	1.897	1.825	0.167	0.305
Constant	39.734	29.741		

[a] Model summary: $p = .413$, $R = .300$, $R^2 = .090$, adjusted $R^2 = .001$

Table 18

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Bodily Pain Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	1.369	10.139	0.022	0.893
Age	0.036	0.380	0.015	0.925
Revision shoulder surgery	-1.492	8.206	-0.030	0.857
Number of WCF claims	-0.109	1.671	-0.011	0.948
Constant	54.290	27.233		

[a] Model summary: $p = .999$, $R = .048$, $R^2 = .002$, adjusted $R^2 = -.095$.

Table 19

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 General Health Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	8.319	8.260	0.154	0.320
Age	0.329	0.309	0.160	0.294
Revision shoulder surgery	-3.249	6.685	-0.076	0.630
Number of WCF claims	-1.324	1.362	-0.154	0.337
Constant	39.700	22.187		

[a] Model summary: $p = .286$, $R = .336$, $R^2 = .113$, adjusted $R^2 = .026$.

Table 20

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Mental Health Component Summary Score[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	8.592	4.942	0.237	0.090
Age	0.428	0.185	0.310	0.026
Revision shoulder surgery	-3.056	4.000	-0.106	0.449
Number of WCF claims	2.570	0.815	0.444	0.003
Constant	10.693	13.275		

[a] Model summary: $p \leq .005$, $R = .545$, $R^2 = .297$, adjusted $R^2 = .229$.

Due to the significant findings of the analysis for the MCS scales, the SF-36 subscales that contribute to this score were examined. The goal of the further analysis was to obtain a more detailed picture and better information about the RCR patient and functioning. Therefore, the remainder of this chapter is devoted to the regression analyses of the SF-36 mental functioning subscales.

The simultaneous-entry regression model was examined for the vitality (VT) and social functioning (SF) subscale of the SF-36v.2 (see Table 21 and 22). The vitality scale measures the extent to which a person feels full of energy and life versus tired and worn out. The social functioning subscale measures the extent to which physical health and emotional difficulties have affected a person's ability to engage in social situations and activities. Both multiple regression analyses were not statistically significant at the set alpha level of .05, thus the predictors did not contribute significantly to the variance in either the vitality or social functioning subscale score.

Table 23 presents the multiple regression model for the role-emotional (RE) subscale of the SF-36v.2. This subscale of the SF-36 assesses the difficulties in performing work and daily living activities caused by emotional factors. The four-variable regression model was significant, $F = 4.200$, $p \leq .01$, with an R^2 of .291. That is, nearly 30% of the total variance in the RE subscale can be explained by the four predictor variables in the model. The individual predictors that were most influential to the model were gender, age and number of WCF claims, with alpha levels $\leq .05$. Number of prior WCF claims was the most influential of the predictors with the highest beta weight ($\beta = .383$). Age was the next highest beta weight that reached significance ($\beta = .328$), followed by gender ($\beta = .278$). Thus, among this sample, patients with higher numbers of

Table 21

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Vitality Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	3.078	8.512	0.056	0.720
Age	0.135	0.319	0.065	0.673
Revision shoulder surgery	-8.376	6.889	-0.191	0.231
Number of WCF claims	2.589	1.403	0.295	0.072
Constant	41.415	22.863		

[a] Model summary: $p = .398$, $R = .304$, $R^2 = .092$, adjusted $R^2 = .004$.

Table 22

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Social Functioning Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	13.394	11.991	0.170	0.271
Age	0.721	0.449	0.240	0.116
Revision shoulder surgery	-7.727	9.705	-0.123	0.430
Number of WCF claims	2.603	1.977	0.207	0.195
Constant	23.838	32.209		

[a] Model summary: $p = .220$, $R = .357$, $R^2 = .128$, adjusted $R^2 = .043$.

Table 23

Simultaneous-Entry Multiple Regression Model Predicting the SF-36 Role-Emotional Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	20.033	9.865	0.278	0.049
Age	0.899	0.370	0.328	0.019
Revision shoulder surgery	-1.893	7.984	-0.033	0.814
Number of WCF claims	4.405	1.626	0.383	0.010
Constant	-5.557	26.497		

[a] Model summary: $p \leq .01$, $R = .539$, $R^2 = .291$, adjusted $R^2 = .221$.

WCF claims, females, and older patients had fewer difficulties with daily activities as a result of emotional problems.

The remaining regression analysis examined the SF-36 mental health subscale. This subscale assesses a person's current levels of depression and anxiety. The model summary of the regression analysis was significant, $F = 2.751$, $p \leq .05$, with a R^2 of .212. The four predictors accounted for 21.2% of the total variance in the mental health subscale score. Table 24 depicts the contribution of the individual predictors to the model. The number of previous WCF claims was the only variable observed to be significant among the individual predictors ($p < .01$) with the highest beta weight reported thus far ($\beta = .408$). That is, patients that reported less current levels of depression and anxiety had higher numbers of WCF claims than patients with less claims.

Table 24

Simultaneous Entry Multiple Regression Model Predicting the SF-36 Mental Health Subscale[a]

	Coefficients			
	Unstandardized		Standardized	
Variable	β	*SE*	β	*P*
Gender	11.764	9.711	0.175	0.233
Age	0.598	0.364	0.234	0.108
Revision shoulder surgery	-6.679	7.859	-0.125	0.400
Number of WCF claims	4.379	1.601	0.408	0.009
Constant	19.570	26.083		

[a] Model summary: $p \leq .05$, $R = .460$, $R^2 = .212$, adjusted $R^2 = .135$.

Summary of Predicting Outcomes

The five variable regression models were significant within the mental health summary score and two of the four mental health subscales. Meaning, a significant amount of variance in the mental health functioning summary, role-emotional, and mental health subscale was accounted for by the predictors examined. The predictors were not significant for any of the physical functioning scales, including the shoulder specific indices.

In summarizing the analyses of individual predictor variables within the models, it is apparent that the number of previous WCF claims of a patient is related to higher levels of disability but also higher mental health functioning, less difficulties in daily activities due to emotional problems, and less current levels of depression and anxiety. A summary

of the frequency of statistical significant for the predictors is as follows: gender of the patient (1/12), age of the patient at time of rotator cuff repair (2/12), presence of revision shoulder surgery (0/12), and the number of WCF claims (4/12).

An examination of the correlation coefficients between predictor and outcome variables revealed several of the predictors were significantly correlated with outcomes. The predictors of number of children and presence of a case manager correlated with outcomes more often than any of the remaining variables examined. A summary of the frequency of statistical significance for the presurgical variables in predicting outcomes is as follows: patient gender (0/12), patient age (3/12), income (0/12), presence of a lawyer (0/12), diagnosis (1/12), number of WCF claims (2/12), previous shoulder operation (0/12), total WCF costs incurred (5/12), marital status (0/12), case manager (6/12), number of children (6/12), history of tobacco (5/12), and educational level (5/12).

CHAPTER V

DISCUSSION

The purpose of the current study was to utilize a retrospective cohort design to better understand various research questions related to rotator cuff repair patients covered by the WCFU. The questions examined in this study are linked to three primary objectives: (a) to describe the characteristics of Utah workers that underwent RCR surgery, (b) to examine postsurgical outcomes following RCR surgery (e.g., physical functioning, quality of life, overall health status, patient satisfaction, and return to work), and (c) investigate the utility of the biopyschosocial model in predicting RCR outcome variables. The initial section of this chapter will discuss the results for each objective and interpretation of these results, followed by implications of the findings, limitations of the research, and suggestions for future studies.

Characteristics of Patients Prior to Rotator Cuff Repair Procedure

Limited information has been collected regarding the biopsyhosocial status of injured worker's compensation prior to RCR patients. The first objective of this study was to describe the presurgical patient characteristics of this worker's compensation Utah sample of patients who have undergone rotator cuff repairs. Generally speaking, workers' compensation populations differ from other working populations on a variety of patient characteristics and physical outcome measures. Research has documented poorer outcomes among workers' compensation groups as compared to the general working population (Henn et al., 2008). Compensated patients report longer recovery times, more

psychological dysfunction, and more pain than their noncompensated counterparts (Greenough et al., 1998; Harris et al., 2005; Watson et al., 2002). To address the need to describe the characteristics of this workers' compensation group, demographic variables were collected and analyzed. The current study's sample was approximately 84% male with a mean age of 55 at time of the RCR. A recent study by Henn et al. (2008) that examined compensation status among RCR patients reported 61.5% male and the mean age of 52.5 years. The workers' compensation sample had a higher percentage of males than females, which is consistent with the current sample. Compared to other studies that have examined compensation status, the current sample is slightly older and a higher percentage of male patients than other compensation samples (Henn et al., 2008; Nicholson, 2003; Viola, Boatright, Smith, Sidles, & Matsen, 2000).

With respect to income, the current study sample made on average $763 a week. The U.S. Census data reveal that weekly income is higher on average within Utah and the general population (i.e., $1091 and $992, respectively) than within this RCR sample. The current population statistics report that within Utah and the United States that gender is approximately split 50% female/male (USDL, 2009b). These findings suggest that generalizing the current study results to the general population would be challenging. Despite these findings, the aim of the current study was to describe characteristics and outcomes of Utah worker's compensation rotator cuff repair patients and not the general population.

The type of injury to the rotator cuff can affect the extent and type of procedure needed to fix the repair. Much has been reported within previous literature about the use of specific procedures such as open- or arthroscopic repairs with specific types of injuries

(Cofield et al., 2001). Diagnosing the incidence of different injuries within the general population is difficult because it requires examining the injury surgically, with medical imaging equipment, or after a patient is deceased. A study of rotator cuff tears within 307 cadavers found the incidence of partial thickness tears to be 32%, and 19% that had complete tears to the supraspinatus tendon (Matava, Purcell, & Rudzki, 2005). In the current study, 35% had a partial thickness tear to the rotator cuff tendon and 15% of patients had a complete tear (including a bicep rupture). These rates are comparable to rates seen in general population cadavers (Matava et al., 2005).

Fifty-one percent of the sample had at least one prior shoulder surgery before the current surgery examined. Research examining rates of tears after initial surgery has reported the occurrence of a re-tear after both arthroscopic and open rotator cuff surgery to be 31% and 47%, respectively (Bishop et al., 2006). The current sample had a higher percentage of prior shoulder surgeries than the general population.

The health variables identified in the current study included obesity and tobacco use. Depression status was not recorded in the medical chart files reviewed for rotator cuff patients. Lack of information about psychological disturbance variables such as depression within the medical charts reviewed suggests that these variables are typically not examined prior to surgery, at least in Utah. Obesity status was coded in only two patient files with height and weight information not available, making comparisons to previous literature difficult. A history of tobacco use was observed in over half of the patients (54.3%) that were contacted in Phase 2 of the study. One previous study examining the effect of preoperative tobacco use in RCR patients revealed that 42.4% of the total patients examined were current smokers (Mallon et al., 2004). Another study on

rotator cuff repairs, reported that of the workers' compensation patients, 30.8% of them were smokers.

Few RCR studies have examined the effect of presence of litigation. One study examining impingement syndrome within the shoulder, found that 28% of the patients were involved in litigation (Frieman & Fenlin, 1995). The current sample had much lower rates of litigation (6%) than spine surgical studies of workers compensation groups that have reported rates ranging from 12% to 33% of the sample is involved in litigation (Christensen, 2010; DeBerard, LaCaille, Spielmans, Colledge, & Parlin, 2009; LaCaille et al., 2005). The collection of data on the presence of prior WCF claims as it pertains to RCR patients does not appear to have precedent in the literature.

One other research study that examined rotator cuff repairs and concurrently measured workers' compensation status within these patients observed that 59% were married and 10.3% were college graduates (Henn et al., 2008). The proportion of patients married (60.2%) and college graduates (10.7%) is commensurate with the previous studies rates.

Multidimensional Outcomes of Rotator Cuff Repairs

Based on a search of the WCFU database files, 93 individuals were identified that meet inclusion criteria and had undergone a RCR. Of these patients, 47 were successfully contacted and participated in the data collection process at follow-up. Mean comparisons were analyzed for responders and nonresponders to be confident that responders did not differ significantly from nonresponders. The two groups were found to be indistinguishable on a number of various patient variables based on the statistical

analysis performed. The only variable found to be significant was age (p = .04), thus the current result may only generalize to older RCR patients. Although, previous research on the prevalence of rotator cuff repairs found that rotator cuff tears are significantly more likely to be present in people over the age of 50 and that prevalence rates only increase with age (Milgrom et al., 1995; Tempelhof, Rupp, & Seil, 1999). The results of the current study could be considered more applicable to this age group of the population.

The following sections will examine the multidimensional outcomes in a manner similar to the previous chapter. The sections included in this chapter are patient satisfaction, categorization of outcome, subjective pain levels, disability status and functional impairment, and general physical/mental health functioning.

Patient Satisfaction Outcomes

Many have argued the importance of patient satisfaction items in evaluating pain interventions (Hudak & Wright, 2000). Typically, rotator cuff repair patients have overwhelmingly reported that they are satisfied with the outcome of their surgery, regardless of the type of procedure performed (Romeo et al., 1999; Youm, Murray, Kublak, Rokito, & Zuckerman, 2005). Youm et al. (2005) reported that 83 out of 84 patients were satisfied with the results of their surgery. Comparatively, the current sample reported more dissatisfaction with the repair (31.9%) than nonworkers' compensation RCR samples (Romeo et al., 1999; Youm et al., 2005).

Despite the higher amounts of dissatisfaction with the repair, most of the patients agreed that they would have the procedure done again and that their quality of life had been improved. The current sample may have had higher expectations of pain relief, and quality of life before the procedure and these expectations were only partially met, thus

leading to more reported dissatisfaction with their outcomes. Perhaps patients are more willing to undergo the RCR given rotator cuff repairs are generally less invasive and typically require less recovery time than other joint repair surgeries.

Categorization of Outcome

The Simple Shoulder Test (SST) has been used in RCR outcome studies as a self-report assessment of the repair that allows for a diagnostic of physical functioning based on a total score. The current study categorized these total scores into categorizes of good, fair, or poor outcomes based on previous research (Godfrey et al., 2007) with the SST. A brief comparison of the current sample data with RCR surgery patients 1-year postsurgery (Skutek, Fremerey, Zeichen, & Bosch, 2000), shows that on average patients report a fair outcome (score of 6.97), which differs from the current sample. Patients reported considerable higher percentages of poor outcomes than other noncompensated RCR samples but were comparable to another study that assessed workers' compensation status (Godfrey et al., 2007; Skutek et al., 2000).

One third of patients within this study were not working and considered disabled due to the shoulder injury and postsurgical repair. Disability has largely been measured in terms of pain reduction and basic functional improvements within the shoulder repair literature. Rate of disability within the RCR population have been reported as 20% (Kronberg, Wahlstrom, & Brostrom, 1997). The current sample reported much higher rates of disability. The current study's disability rates can be compared to rates of disability reported for other postsurgery workers' compensation spine samples, including 39% for RF neurotomy, 38% interbody cage fusion, and 12% of discectomy patients (Christensen, 2010; DeBerard et al., 2009; LaCaille et al., 2005). The current study's

percentage of disabled is surprising high considering this surgery tends to be less invasive than these spinal procedures. The noticeable high rates of both poor functioning in the shoulder and rates of disability within this sample could reflect the effect of compensation status upon rotator cuff repairs.

Subjective Pain Levels

Outcome measures and patient survey instruments were initially established for studying spine patients and were adapted for the current population of rotator cuff patients (DeBerard, 1998). A number of survey items were added to the current study to supplement information about subjective pain levels as reported by the patient. First, was the GPE, a single-item, nonstandardized question used within research on the spine that asks the participant to provide a rating of the pain relief in comparison to when the pain first began. Other studies of rotator cuff repairs have found that most patients (80% or more) rate their relief of pain as excellent or good (Gartsman et al., 1998; Iannotti, 1994; Warner, Tetreault, Lehitinen, & Zurakowski, 2005). Comparatively, the current findings indicate that the current sample did not rate their pain relief as positively as other RCR populations.

The VAS or VNRS (0-10 pain rating scale) are used within rotator cuff research and spine research as a principal outcome assessment. The current study collected data on the VNRS at patient follow-up. Previous research collected with full thickness tears among RCR patients have found that 82% of patients rated their pain as less than or equal to a 2 on a scale of 10, with 0 being *no pain* and 10 being the *worst pain imaginable* (Romeo et al., 1999). This RCR sample consisted of 63.8% of patients rating their pain as less than or equal to a 3, with the remainder of the sample reporting higher levels of pain.

The current study's patients' pain ratings were higher despite the presence of less severe injuries (i.e., partial thickness tears).

Another method used to assess outcomes within this study was to code for both the presence of additional shoulder surgeries and the number of procedures performed since the initial shoulder operation. It was hypothesized that patients who required additional surgeries had worse outcomes than those that did not require an additional repair. Within the RCR literature, repairs that are successful and do not require additional procedures (i.e., shoulder revisions) are significantly superior than repairs that re-tear (DeOrio & Cofield, 1984; Gerber, Fuchs, & Hodler, 2000). The more repairs a rotator cuff requires, the less likely a patient will have full or even partial functioning of the shoulder (DeOrio & Cofield, 1984). Most of the patients from the current study had no additional procedures (61.7%) scheduled or performed. Among complete, massive tears of the rotator cuff the rate of re-tear has been reported to be as high as 50-70%, but much lower in less serious injuries (Gerber et al., 2000). Comparatively, this study had lower rates of re-tear, which could be because only 15% of the injuries were complete tears. Certainly, the addition of less severe injuries in the current analysis affected the rate of re-tear.

General Physical and Mental Health Functioning

Scores on the SF-36 v.2 revealed better functioning when compared to the general population normative data. In fact, RCR patients reported fewer limitations due to emotional or physical problems, better social and mental health functioning than the general population. Additionally, means for the current workers' compensation RCR

sample were within one standard deviation below the means for a nonworkers' compensation RCR sample on all subscales and component scale scores. The workers' compensation sample of patients that underwent a RCR reported worse functioning on all scales with the greatest areas of impairment on vitality, the mental health subscale, and the mental component scale score. It should be noted that a precise comparison of data for rotator cuff samples is not entirely possible due to the use of a pervious version of the questionnaire examined in other rotator cuff studies. If the current study of workers' compensation RCR patients is compared to previous research, despite the variation in versions used, the current sample reports better outcomes on all subscales and summary scores than the general population, but worse than noncompensated RCR samples (Gartsman et al., 1998; Henn et al., 2008).

Despite the lack of a direct comparison sample within the RCR population, a number of other studies have used the SF-36 with spine surgery patients at WCFU (Christensen, 2010; DeBerard et al., 2001; LaCaille et al., 2005). These researchers have found spine patients to score lower than the general population norms, and significantly lower than the current sample of RCR patients on all subscales and summary scores. Thus, RCR patients had higher scores on the SF-36, reflecting better general health functioning than these spine populations (Christensen, 2010; DeBerard et al., 2001; LaCaille et al., 2005).

The finding that the current sample of workers' compensation patients had better functioning than both the general population and other workers' compensation populations is a notable discovery worth further discussion. If these findings are combined with results from the GPE and quality of life items, a picture of overall health

and physical outcomes begins to develop for the average RCR patient examined within this population. Despite the existence of disability, and lack of full functioning in the shoulder, patients reported that their pain has been relieved, their quality of life is better, and they report better general health functioning than the general population, but possibly not better outcomes than noncompensated populations.

Intercorrelations Among Variables

The intent of the results from the correlational analysis was to provide further information about the nature of the relationships between the variables examined within this study. Given the large number of variables involved in the analyses, only a few select correlations will be discussed within this section encompassing the most noteworthy of relationships between and among the variables. With regard to the intercorrelations among outcome variables, the findings were consistent with expectations with a few exceptions. For example, the more improved the patient rated their quality of life also resulted in the more satisfaction they expressed with the outcome, better general physical and mental health, and less disability and bodily pain experienced.

A number of variables correlated highly with disability status, thus giving a description of the overall health of those disabled due to their shoulder. These individuals were not satisfied with their surgery, had a decreased quality of life, were in more pain, and reported lower scores on all SF-36 items. Many of these correlations were anticipated, particularly the relationships between disability and physical health. Contrary to expectations was the fact that the mental health component summary score

correlated highly with disability status. People that reported themselves as disabled had worse mental health functioning, more so than poorer physical health.

It was originally thought that whether a patient would have the procedure over again, given what they currently know, would be related to measures of health functioning, and quality of life. The lack of correlation between patients' retrospective analysis of whether they would have the procedure done again and all other variables is surprising.

Another correlation matrix was generated to investigate the relationship between patient characteristics and a select number of outcome variables (i.e., SST scores, disability status, SF-36 subscales and component scores). Most notably, number of children correlated with a number of SF-36 subscales and the mental health summary scale. That is, patients that had more children reported more limitations to daily living due to physical and emotional problems, decreased social and mental health functioning. Number of children was highly correlated with patients' responses to general health and social functioning items. There is little precedent within the previous literature to help interpret these findings, so any hypotheses would only be speculation.

The presence of a case nurse manager is another variable that is unique to the current study. A patient that had a case nurse manager assigned to their claim were likely to report worse outcomes for emotional, physical, and social functioning as measured by the SF-36 subscales. Nurse case managers are registered nurses that are assigned to a patient to help in the utilization of health care services and needs. The duties and functions of a case nurse manager can include (but are not limited to) devising a health care plan, acting as a liaison between patients and health care professionals, and working

to ensure the patients' healthcare services are administered promptly and efficiently. These findings suggest a further review of whether case nurse managers are necessary to a patients' recovery and functioning is warranted.

Recall the mean age of the current sample is approximately 57 years old, so it is surprising that patients would report better shoulder functioning, and mental health functioning than younger patients. The current findings are in contrast to the previous RCR literature but little attention has been given to this variable (Holtby & Razmjou, 2009; Romeo et al., 1999; Watson & Sonnabend, 2002).

Prediction of Rotator Cuff Repair Outcomes

Many have discussed the lack of information about biopsychosocial variables ability to predict outcomes within the RCR literature at large, and more specifically within workers' compensation RCR patients. Considering the extensive amount of research that has examined compensation status among other populations, it is surprising the lack of information among the most common procedure performed on the shoulder. The current study investigated a four-variable model and this model's capability to predict multidimensional outcomes following rotator cuff repairs with compensation patients.

Four-Variable Model as a Predictor of Outcomes

As a whole, the four variables used within the regression model correctly predicted patient outcomes as measured by disability status, shoulder specific functional impairment, and general physical and mental health inconsistently. Regarding patient

disability, the overall model achieved an overall hit rate of 71.7%, and lead to a better prediction of disability status than observed base rates alone. The multivariate model improved on the prediction of nondisabled patients by 22.5%. The model accounted for a significant amount of variance (ranging from 21-30%) within patient mental health outcomes as assessed by the subscales and summary scores of the SF-36. Individual variables contributed different to the model's predictive efficacy with the most consistent contribution coming from the number of prior WCF claims. Overall the model lacked the ability to predict mental and physical health outcomes, which could be due to the pilot nature of this study. The variables selected for inclusion were significant within the RCR literature individually as predictors but failed to be predictive when selected for a multivariate analysis. Each of the four patient variables from the model will be discussed in detail below.

Gender

A few RCR studies have examined gender in relation to outcome factors with mixed results (Cofield et al., 2001; McCallister, Parsons, Titelman, & Matsen, 2005; Milano et al., 2007; Romeo et al., 1999). Among studies finding a significant effect for gender as a predictor, women were found to have worse physical functioning after surgery and reported more pain than men (Cofield et al., 2001; Romeo et al., 1999). These same studies reported that they had no clear explanation for these adverse findings for gender on the outcomes reported (Cofield et al., 2001; Romeo et al., 1999).

Within the current study, gender was not a significant predictor of disability status, shoulder specific functional impairment, and most of the SF-36 subscales and summary scales. These findings support more recent RCR studies that found a lack of

predictability for gender (McCallister et al., 2005; Milano et al., 2007). These studies examined the effect of repairs within noncompensated samples and found that men and women recovered and functioned at similar rates. The current findings support the same lack of effect gender has on various outcomes. A person can have a successful recovery regardless of their gender. One possibility for these findings is that advances in shoulder repair techniques and the development of apparatus more appropriate for women have helped to improve outcomes for women.

Gender was a significant predictor in the multivariate model examining the SF-36 subscale of role-emotional, meaning, a person's gender did predict the amount of disturbance to daily living activities and social events due to emotional problems. Previous literature examined was unsure of how to explain the adverse findings of the female gender on outcomes and these findings may help to clarify the effect of gender on previous disability findings (Cofield et al., 2001; Romeo et al., 1999).

Age at Time of Repair

Age of patient at time of repair was included in the current analysis and deemed important based on literature reviewed to assessing both short- and long term outcomes of patients. Research has noted that age-related changes are important factors to include in assessing long-term RCR outcomes (Galatz, Griggs, Cameron, & Iannotti, 2001). Research results within the RCR literature have found age to be both significant and nonsignificant in predicting physical outcomes thus making interpreting the effect of age difficult (Fehringer et al., 2008; Romeo et al., 1999; Watson & Sonnabend, 2002).

Within the current sample, age was a significant predictor for the mental health component summary scale score and the role-emotional subscale of the SF-36, with

p = .026 and .019, respectively. Age was not a predictor for physical health outcomes, shoulder functioning, or disability status for this compensated RCR patient sample. The finding that older-aged patients do not necessarily experience poorer physical disability is a surprising finding. In the U.S., disability rates, as self-reported, have been found to double from the 18- to 44-year-old range to the 45- to 65-year-old range and increase even further with the 65 and older population (Center for Disease Control, 2009; CDC).

One plausible explanation for the finding that age is not predictive of disability or physical functioning within this RCR sample has been suggested by other researchers is that the level of disability decreases in a shoulder as a person ages, not necessarily from the repair of the shoulder but from the decreased activity level and demand placed on the patient's shoulder (Galatz et al., 2001). The current study in Phase 2 data collection included participants within a restricted range. Age was the only variable that responders had a significantly different average than nonresponders. Participants within the current sample that responded to the outcome surveys were older than most of the working population with an average age of 57. Nonresponders were on average 5 years younger than responders for the current study. It is possible that some generational effect was present with the collection of data from responders versus nonresponders.

Age was predictive of general mental health functioning and limitations within patients' daily activities that were due to emotional problems. Previous RCR research may have failed to distinguish between physical health and mental health functioning in determining whether age is related to these outcomes (Fehringer et al., 2008; Romeo et al., 1999; Watson & Sonnabend, 2002).

Prior Shoulder Operation

The presence of a prior shoulder surgery has been examined recently as a significant predictor of longer recovery and worse physical functioning (DeOrio & Cofield, 1984; Harryman et al., 1991; Watson & Sonnabend, 2002). In fact, Watson and Sonnabend (2002) found the presence of a prior shoulder operation within a patient's history to be indicative of a worse outcome after the current shoulder repair. Clinicians have coined the term, revision, to refer to a patient undergoing another surgery that has been previously surgically repaired. Although not as recent, Harryman et al. (1991) found that prior shoulder surgery was predictive of negative outcomes but only with the co-occurrence of an extensive injury. Although, other research has found that number of previous operations to the shoulder did not affect the results of the repair (Neviaser & Neviaser; 1992). The presence of a previous shoulder surgery has not been examined in connection with a workers' compensation sample.

The presence of a prior shoulder operation within the patient's medical history was not a significant predictor within the current sample for a patient's disability status, functional impairment, or general health. Despite the lack of predictability of this variable, these findings are noteworthy due to the presence of conflicting findings that has existed within previous literature on whether this variable is important or not. Also, these findings indicate that specifically for workers' compensation patients, the existence of a previous shoulder surgery is not indicative of longer recovery times, worse physical functioning, and disability. This information has a variety of uses in clinical settings for patients, medical personnel, and policy makers. For example, clinicians may use this information in making decisions about whether a revision is appropriate with a workers'

compensation patient and patients may use this information in weighing the costs versus benefits of undergoing a revision.

Number of Previous Workers' Compensation Fund Claims

The number of all previous WCF claims in general that a patient had was the most robust predictor of poorer outcomes within the current study. Compensation status has been shown to lead to poorer outcomes including longer recovery times and worse physical functioning (Greenough et al., 1998; Harris et al., 2005; Henn et al., 2008; Watson et al., 2002). Rotator cuff repair studies have reported that patients' on workers' compensation are more likely to report worse outcomes after surgery (Watson & Sonnabend; 2002). These findings are not unique to the RCR population, they have also been observed within back, knee, and hip repair populations (Harris et al., 2005). Although workers' compensation status has been examined within studies of rotator cuff repairs, no studies have examined the effect of the number of WCF claims on disability or functional outcomes.

For the present analysis, number of previous WCF claims was a significant predictor of disability status. As expected, those with more claims were also currently disabled. That is, patients that continue to have WCF claims will be more likely to remain in the health care system and eventually become disabled. Preventing reoccurrence of all injuries becomes an important factor in preventing disability.

Similarly, RCR patients' number of WCF claims was a significant predictor of the mental health summary score, mental health subscale, and the role-emotional subscale of

the SF-36. Patients that had more claims also had worse mental health functioning and more problems within their daily activities due to emotional disturbances.

Implications

There are several noteworthy implications for RCR patients, particularly those covered by workers' compensation that are provided from the current study findings. Few studies have examined RCR outcomes from a biopsychosocial perspective. Little-to-no attention has been given within the literature that describes patient characteristics and biopsychosocial predictive variables in regards to workers' compensation RCR patients. Despite this lack of attention within the RCR literature, psychosocial characteristics are associated with disability and patient functioning in other surgical populations (DeBerard et al., 2001; LaCaille et al., 2005). The current study demonstrated the relationship between certain biopsychosocial factors and their ability to predict RCR outcomes, and provides further information about this particular population. The study findings provide support for the utility of preprocedural variables in assisting to identify patients that may have worse outcomes or a greater propensity for disability than other patients. Furthermore, the various patient characteristics gathered within the context of this study further illuminates the complexity of compensation populations. For instance, almost one third of these patients were disabled, 56% had prior WCF claims, 54% smoked, 51.8% had a shoulder revision surgery, their average income was $763 a week, and incurred on average $67,000 in compensation costs. This information can help to better inform physicians and pain specialists about the complex factors that influence

compensation patients that are undergoing a RCR and help provide these patients with better treatment.

The previous body of RCR literature to date has primarily focused on self-reported pain relief, patient satisfaction, and quick assessments of physical functioning as the primary sources of evidence of success, with limited attention paid to outcome categories such as overall shoulder physical functioning, and disability status. Multidimensional outcomes were examined from a broad perspective of functioning. The current study's methodology incorporated the use of standardized assessments to facilitate the ability to make comparisons with other RCR samples and other surgical procedures that used similar methods (Christensen, 2010; DeBerard et al., 2001; LaCaille et al., 2005). When compared to other surgical procedures performed with a similar population of patients, these patients reported better quality of life and less pain, but worse quality of life and more pain than noncompensated populations of RCR (Christensen, 2010; Romeo et al., 1999; Youm et al., 2005). These findings add support to previous research that suggests compensated patient populations report worse outcomes regardless of the type of procedure.

Additional information was provided within this study concerning the practice of determining which candidates may have better outcomes than other patients. Several patient characteristic variables are thought to be predictive of poorer outcomes as described within the previous literature (Galatz et al., 2001; Romeo et al., 1999; Watson & Sonnabend, 2002). These patient characteristics such as age, gender, and presence of a prior shoulder operation have been discussed within the noncompensated RCR literature as influential in patient outcomes (Djurasovic et al., 2001; Henn et al., 2008; Watson &

Sonnabend, 2002). In the current study, older age patients and women were not more likely to have higher rates of disability, and worse physical functioning, contrary to the current literature on rotator cuff repairs (Cofield et al., 2001). Also, it certainly is noteworthy that compensated RCR patients with an increased number of prior WCF claims tend to be more disabled than their counterparts. Thus, these results provide a perspective into patient selection characteristics that could be important in successful outcomes and further information about compensated patient characteristics previously examined within the noncompensated population of rotator cuff repairs. It should be noted that these findings are preliminary and further research regarding the variables of interest and outcomes is needed before conclusions can be made.

Limitations and Future Research

There are several limitations to the current study that should be noted. First, the current study used a retrospective cohort design without a matched control group for comparison of outcomes. The design was dependent on the existing sample of repair patients and their medical chart information previously collected. There was no opportunity to gather further information or administer measures prior to rotator cuff surgery for the purpose of comparing pre- versus postsurgery change. Thus, without this comparison data or control group data, it would be impossible to come to any conclusions about the effectiveness of the rotator cuff procedure. Any changes observed could certainly be caused by natural shoulder deterioration/healing or regression to the mean. In fact, researchers have suggested that older patients' shoulder pathology does not necessarily heal when they report improvements; rather the decreases in activity levels

associated with older age result in less pain (Galatz et al., 2001). Also, there certainly could be an impact from the placebo effect upon the current results examined. Surgical intervention effects, much like medical interventions, are often complicated by placebo effects (Turner, Deyo, Loeser, Von Korff, & Fordyce, 1994). Without the addition of a randomized control group, the possibility that these results are confounded by the placebo effect should be mentioned.

The time from surgery to follow-up varied for patients from 1 to 5 years. The variance in time to follow-up could account for different patient outcomes. It is noted that we examined the correlation of follow-up time interval with patient outcomes and discovered no significant relationships in this study. It is certainly possible that patients could have re-injured the shoulder, have natural deterioration/healing, or experienced other medical treatments.

Despite an extensive medical chart and WCF database file review, there were several obstacles to collecting comprehensive data for all patients. The barriers to collecting complete, comprehensive information on every patient included missing data, inconsistencies within the WCF database or medical chart information, and unclear physicians' notation. Thus, data was not available for every patient for all variables examined.

This project did not make use of multiple research assistants in either the coding of medical information or the phone interviews conducted. Therefore, a certain amount of subjectivity is inherent within the data collection process without the use of multiple researchers to code data and conduct interviews. Multiple researchers could have provided comparison data and estimates of reliability. Also, with regard to the telephone

interviews, the utilization of audio recordings of the interviews and multiple coders could have provided additional comparison data about the reliability of results. Although prior to data collection, the author of this paper did meet with several researchers that had previously used these methods in data collection and was trained to collect both patient WCF file data and phone interview information. It should be noted that once training had finished on how to access information within the WCF system, the collection of patient information was fairly straightforward.

Additionally, the restriction on sample size was a limitation of this study. It was the original intent to make use of approximately 150 participants; however fewer participants were available after review of patient files. Of the patients that met the criteria for review within the WCFU database files, 50.5% of these patients completed the telephone interview. The remaining nonresponder proportion of the patient sample either had out-of-date contact information, or did not answer even after numerous phone calls were made. The smaller sample size lead to less variables being included within the predictive analysis.

Based on the previously mentioned limitations to the current study, there are several recommendations for future research on rotator cuff repairs. First, a randomized control study would provide stronger evidence to the efficacy of biopsychosocial factors ability to predict outcomes. Many of the problems and limitations with the current study were generated from the lack of a control group. The current body of literature focuses mainly on outcomes such as pain reduction and assessments of a few shoulder functions. The addition of outcome factors such as disability status, shoulder and health assessments would help to provide broader view about multidimensional outcomes.

Furthermore, several preprocedural patient characteristics deserve additional attention including the presence of obesity, socioeconomic status, tobacco consumption, depression, litigation, and age. In particular, the inclusion of a younger age group could provide further information about outcomes for this section of the population. The current sample consisted of injured workers being compensated for their injuries and it becomes important that these methods are repeated with other diverse samples. Also, replication of these findings with other compensated samples is important in order to strengthen the ability to generalize and compare these results. Additionally, information about the long-term benefits of RCR would add greatly to the current RCR information and provide a better picture of the duration of successful outcomes.

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APPENDICES

Appendix A:

Medical Records Review Instrument

DEMOGRAPHIC/COMPENSATION VARIABLES

1. Patient Name:

2. Address:

3. Phone Number (home):

4. Claim Number:

5. Gender
0=not reported
1= Male
2= Female

6. SSN:

7. Study Number:

8. Date of Birth:

9. Date of Injury:

10. Hire Date:

11. Months worked for employer prior to injury:

12. Marital Status At Time of Injury:
0=Not reported
1=Married
2=Divorced
3=Separated
4=In a significant relationship (i.e., boyfriend or girlfriend)
5=Single

13. Date of Index RCR Surgery:

14. Time interval between injury and RCR surgery? (Days):

15. Date WCFU File Created:

16. Patient's Weekly Wage at Time of Injury:

_____

0=not reported

17. Case Manager Assigned?
0 = not reported
1 = no
2 = yes

18. Occupation At Time of Injury:

19. Child Care Responsibility:
0=Not reported
1=No
2=Yes
Total # Dependents_____

20. Lawyer involvement in compensation case? (prior to surgery)
0=not reported
1=no
2=yes

21. Red Flags

A. AGE (AG) - Claimant age over 50.....1=yes 2=no
B. ALCOHO (AL) - History of Alcoholism.....1=yes 2=no
C. CREDIB (CR) - Questionable Validity.....1=yes 2=no
D. CUMTRA (CT) - Cumulative Trauma.....1=yes 2=no
E. DISVAL (DI) - Disputed Validity Settlement....1=yes 2=no
F. DRUG (DR) - History of Drug Abuse.....1=yes 2=no
G. EDUCAT (ED) - Education Level.....1=yes 2=no
H. EMPLOY (EF) - Employment Factors.....1=yes 2=no
I. FNCOVER (FO) - Functional Overlay.....1=yes 2=no
J. FRAUD (FR) - Fraud.....1=yes 2=no
K. LEGAL (LG) - Claim Involves Litigation.....1=yes 2=no
L. LIEN (LI) - Claim Involves Lienholder.....1=yes 2=no
M. NESPEK (NE) - Language Barriers.....1=yes 2=no
N. OBESE (OB) - Obesity.....1=yes 2=no
O. OFFCR (OF) - Claimant Officer/Partner.....1=yes 2=no
P. OTHER (OT) - Other Factors.....1=yes 2=no
Q. OVRPAY (OP) - Compensation Overpayments....1=yes 2=no
R. PIREF (PR) - Private Investigator Referred...1=yes 2=no
S. PREEXI (PR) - Pre-Existing Condition.....1=yes 2=no
T. PRIORS (PS) - Claiman has prior claims.....1=yes 2=no
U. PSYCH (PF) - Psychological Factors.....1=yes 2=no
V. PTSD (PT) - Post-Traumatic Stress Dis.....1=yes 2=no
W. SOCIAL (SF) - Social Factors.....1=yes 2=no
Y. SUBSYM (SS) - CLMT has subjective sympt.....1=yes 2=no
X. SYSDIS (SD) - Systemic Diseases..... 1=yes 2=no

22. Description of Accident
a. Accident Code_____
b. Injury Type Code:
c. ICD-9 Code_____
b. Narrative:_____

WORK/COMPENSATION VARIABLES

23. Date Last Worked:

24. History of prior industrial claim? (Generic)
0=not reported
1=no
2=yes
Total Number_____
Specific Code #'s_____
Type of Injury_____
_____

25. History of prior industrial claim? (Shoulder Pain)
0=not reported
1=no
2=yes

Total Number_____
Specific Codes #'s_____

26. Vocational Rehabilitation following surgery?
0=not reported
1=no
2=yes

27. Modified Employment Available
0=not reported
1=no
2=yes

28. Total Paid Temporary Comp:

29. Total Paid Permanent Comp:

30. Total Paid Comp:

31. Total Paid Medical:

32. Total Paid ALAE:

33. Total Paid Rehab:

34. Total Paid to Date:

35. Total ALAE:

36. Total MEDICAL:

37. Total REHAB:

38. Total Comp:	**39. Grand Total Incurred:**	**40. Percent Physical Impairment Paid Out:**
41. Expected Duration	**42. Medical Stability Date:**	**43. Return to Work** 0=not reported 1=no 2=yes
44. Return to Work Date	**45. Time to Medical Stability From Date Of RCR (days):**	**WCFU Adjustor Name:**

PHYSICAL/HEALTH/SURGICAL VARIABLES

46. Physical Exam Data
a. Height_____
b. Weight_____
c. ROM
0=Not Reported
1=Decreased
2=None
d. Supraspinatus weakness (resist downward pressure, empty can, Jobe's test)
0=Not Reported
1=Positive
2=None
e. Infraspinatus/Tere Minor weakness/tear (resist external rotation pressure)
0=Not Reported
1=Positive
2=None
f. Subscapularis weakness (hand on lower back, lift hand off lower back, Gerber lift-off test)
0=Not Reported
1=Positive
2=None
g. Neer test impingement (arm in forced flexion overhead with arm pronated)
0=Not Reported
1=Positive
2=None
h. Hawkins test impingement (arm 90°, elbow flexed 90° rotate the shoulder internally)
0=Not Reported
1=Positive
2=None
i. Apley scratch test (attempt to touch the opposite scapula)
0=Not Reported
1=Positive
2=None
j Acromioclavicular/sternoclavicular joint pain
0=Not Reported
1=Positive
2=None
k. Cervical spine tenderness
0=not reported
1=Positive
2=None
l. Biceps tendon weakness
0=Not Reported
1=Positive
2=None
m. Scapula pain
0=Not Reported
1=Positive
2=None

47. Number of Prior Shoulder Operations?
0=None
1=One
2=Two
3=Three or more ____How many?_____

Date:_____

MD:_____

49. Patients' Secondary Surgical Diagnosis
0=Not Reported
1=Partial tear
2=Full Supraspinatus tear
3=Infraspinatus tear
4=Tere Minor tear
5= Subscapularis tear
6=Multiple tendon tear_____
7= Other_____

51. Imaging Studies Conducted prior to surgery?
0=none reported
1=X-ray
2=CT
53. Type of RCR
0=Open
1=Mini-open repair
2=Arthroscopic Repair

55. Post-Operative Treatment?
0=Not reported
1=Patient Education/Counseling
2=Physical Therapy
3=Manipulation
4=Activity Restriction
5=Devices (Corsets/Casts)
6=Injections
7=Other

57. Additional Procedures Performed:

48. Patients' Primary Surgical Diagnosis
0=Not Reported
1=Partial tear
2=Full Supraspinatus tear
3=Infraspinatus tear
4=Tere Minor tear
5= Subscapularis tear
6=Multiple tendon tear_____
7= Other_____

50.General Health Problems (List up to 5)
0=None reported
1=Diabetes
2=Heart Disease
3=Stroke
4=Arthritis
5=Asthma
7=Hypertension
8=Colitis
9=Psoriasis
10=Cancer history
11=Trauma history
12=Infectious history
13=Auto-immune history
14=Steroid usage
15=Other
52. Size of incision
0= >1 cm
2= >4 cm
3= <5 cm

54. Lifting Restrictions in Pounds Following surgery?:

56. Surgical Complications
0=Not reported
1=none
2=In hospital mortality
3=Deep infection
4=Superficial infection
5=Deep vein thrombosis/ thrombophlebitis
6=Pulmonary embolus
7=Dural Tear-CSF Leak
8=Nerve Root Injury
9=Operation at wrong level
10=Vascular injury
11=other_____

PHYSICAL/HEALTH/SURGICAL VARIABLES

58. Amount of Pain Before Surgery?
0=No Pain or Minimal Pain
1=Mild
2=Moderate
3=Severe

59. Use of Pain Meds Prior to Surgery
0=not reported
1=no
2=yes

60. Smoking at time of Surgery?
0 = Not reported
1 = No
2 = Yes

61. Significant testing after surgery?
0=None Reported
1=X-ray
2=CT
3=MRI
4=CT Myelogram
5=Discography
6=Other_____

62. Alcohol Use at time of Surgery?
0=Not reported
1=no
2=yes

63. Non prescription Drug Use prior to Surgery?
0=Not reported
1=no
2=yes

Type:_____

64: Psychology Evaluation prior to Surgery:
0=Not reported
1=no
2=yes

Copies obtained?
1=no
2=yes

65: If Yes, Diagnosis:
0=Not reported
1=no
2=yes

DSM-IV Code_____

70: History of Depression?
0=not reported
1=no
2=yes

71. Ethnicity
0=Not reported
1=White
2=Black of African American
3=Hispanic
4=Asian or Pacific Islander
5=Native American Indian
6=Other (Specify_____)

72. Educational Level
0=Not reported
1=Less than 12 years
2=12 years (HS Degree)
3=Some College
4=Trade School/AA
5=College Degree
6=Advanced Degree

Appendix B:

WCFU Subject Contact Letter

Study Participant
Address
City, State, Zip Code

Dear Participant:

During the month of March one of our interviewers will be calling you regarding a rotator cuff surgery outcome survey. This survey is being conducted by a team of researchers from the Psychology Department at Utah State University. We are very interested in hearing about the results from your past rotator cuff surgery and have sent this letter to inform you in advance about our request for an interview.

We obtained your name and address from the Workers Compensation Fund of Utah (WCFU). We want to emphasize that this research is being conducted independently from WCFU and that your participation will in no way affect your compensation status or treatment. We are interested in learning how to better predict rotator cuff surgery outcome and the information you provide will help future rotator cuff surgery candidates. People who have had rotator cuff surgery often report both positive and negative results. Your unique experience, whether positive or negative, is very important to us.

The interview will be conducted over the telephone, at your convenience, and will take only 15-20 minutes. All of your responses will be strictly confidential and your participation is completely voluntary. If you would like, we can also send you a summary of our study results.

To help us in contacting you, please fill in your name, address, and phone number on the enclosed postcard and drop it in a mailbox. Your participation will be greatly appreciated since this is a very important study. If you have any questions, please do not hesitate to call me at (435) 797-1462.

Sincerely,

M. Scott DeBerard, Ph.D.
Research Director
Utah Rotator Cuff Outcome Study

Appendix C:

Rotator Cuff Repair Telephone Survey Cover Sheet

PARTICIPANT NUMBER
NAME:

SURG DATE:
TELEPHONE NUMBERS:
Telephone # 1: ( ) ___-____Telephone # 2: ( ) ___-____Telephone # 3: ( ) ___-
ADDRESSES (Circle address that subject payment should be sent to):

Address # 1: _____
_____
_____
_____

Address # 2: _____
_____
_____
_____

Address #3: _____
_____
_____
_____

Address # 4:

CONTACT HISTORY:

Date	**Time**	**Outcome of Call**
1.		
2.		
3.		
4		
5.		
6.		

FINAL STATUS OF SUBJECT PARTICIPATION:
1=Contacted but declined to participate
2=Contacted and completed only part of survey
3=Contacted and completed entire survey
4=Could not be reached
5=Participated and wants a study summary sent to them
6=Other_____Notes:

Appendix D:

Telephone Survey Script

UTAH ROTATOR CUFF REPAIR OUTCOME STUDY
TELEPHONE INTERVIEW SCRIPT

Hello. Is this the _____residence? (If wrong number, then terminate).

This is _____ calling from Utah State University. We are conducting a study to learn more about people who have rotator cuff repair surgery.

Earlier this month a letter describing the study was sent to you? Did you receive it?

If yes: Proceed with the rest of the introduction

If no: "I am sorry it did not reach you. The letter was to inform you of this call and the nature of the study."

PROCEED TO INTRODUCTION:

INTRODUCTION

As the letter indicated you were chosen for this study because you had rotator cuff surgery. Your opinion of how you have progressed since the surgery is critical to this study and results of the survey will be used to help others who are considering having rotator cuff surgery. Your participation is voluntary and your treatment or compensation status will in no way be affected by your participation. For your participation in the survey we will be enrolling you in a drawing for $500.00 and we could also send you a brief report of the study findings. All of your answers will be kept confidential as provided by law and you may skip any questions you prefer not to answer. Okay?

Please feel free to ask questions at any time during the survey. The survey will take about 20 minutes to complete. Is this a good time"?

Yes: Proceed with Survey

No: When would be a time to call you back?
Date:
Day:
Time:

Appendix E:

WCFU-Employer Satisfaction Questions

Let's begin with a few questions about how you feel your claim was handled by the Workers Compensation Fund and your employer. Okay?

WORKER'S COMPENSATION QUESTIONS

1. Overall, where you satisfied with how the Workers Compensation Fund of Utah handled your rotator cuff surgery claim?
1=Yes
2=No
3=Undecided
4=Other

_____
_____
_____
_____
_____

2. Overall, did you feel that the Workers Compensation Fund of Utah responded fairly to your health concerns?
1=Yes
2=No
3=Undecided
4=Other

_____
_____
_____
_____
_____

3. Overall, did you feel that your employer responded fairly to your health concerns?
1=Yes
2=No
3=Undecided
4=Other

_____
_____
_____
_____
_____

Appendix F:

Global Perceived Effect, Verbal Numeric Rating Scale, Patient Satisfaction and Demographic Questions

Utah Rotator Cuff Repair Outcome Study Telephone Survey -

The next part of the survey will involve some general questions about how you have done since you had your surgery. Please respond to each question according to how you feel today. Okay?

1. Is your quality of life better or worse as a result of surgery? That is, is it: 1=A great improvement 2=A moderate improvement 3=A little improvement 4=No change 5=A little worse 6=Moderately worse 7=Much worse	**2. Given what you know: If you could go back in time, would you choose to have the surgery again?** 0=Undecided 1=No 2=Yes	**3. What was your principal occupation/job title at the time of your injury?:**
4. Are you currently working? 1. No 2. Yes, Full Time 3. Yes, Part Time 4. No answer	**5. If not working, which of the following best describes why you are not employed?:** 1. I am still disabled 2.I am not disabled & I want to work but cannot find a job. 3. I was laid off. 4. I am a student. 5. I am a homemaker. 6. I am retired 7. Other_____ 8. No answer	**6. How many days have you worked in the past 4 weeks?**
7. How many hours a week do you usually work at your job?	**8. Did you change jobs because of your shoulder problem?** 1=no 2=yes 3=not applicable 0=No answer	**9. Do you currently retain an attorney because of your shoulder problems?** 1=no 2=yes 0=No answer
	10. Do smoke now? 1=no 2=yes 0=No answer **15.a. Ever Smoked? 1=yes/2=no** **Last Time Smoke_____** **#Cigarettes: day_____years_____**	**11. Have you had any shoulder operations since your initial operation?** 1=No 2=No, but I'm scheduled to 3=Yes **Operation Types:**
12. Overall, is your shoulder problem better than or worse than you expected it to be at this point? That is, is it? 1. Much better 2. Somewhat better 3.What I expected 4. Somewhat worse 5. Much worse 6. No expectations	**13. What is the highest year in school you completed?** 1. Less than High School 2. Some High School 3. High School Graduate/GED 4. Attended or graduated from technical school 5. Attended college but did not graduate 6. College graduate 7. Graduate Studies	**14. If you had to spend the rest of your life with your shoulder condition as it is right now, how would you feel about it?** 1. Extremely dissatisfied 2. Very dissatisfied 3. Somewhat dissatisfied 4. Neutral 5. Somewhat satisfied 6. Very satisfied 7. Extremely satisfied
15. On a scale from zero to ten, where zero represents no pain and ten represents the worst pain imaginable, how would you rate your current pain level? **#:_____**	**16. Now, using the same scale, how would you rate your level of pain on average over the past week?** **#:_____**	**17. Compared to when this episode first started, how would you describe your shoulder these days?** 1. Complete relief of pain 2. More than 50% pain relief 3. No change in the level of pain 4. The pain has increased

Appendix G:

Short-Form Health Survey-36 Version 2

Interview Script

Standard Interview Script for SF-36 Health Survey

Script for Interview Administration

***These first questions are about your health now and your current daily activities. Please try to answer every question as accurately as you can.**

1. **In general, would you say your health is…** (read response choices)
(Circle one number)

Excellent……..1
Very good……2
Good……3
Fair……...4
Poor……..5

2. **Compared to one year ago, how would you rate your health in general now. Would you say it is…** (read response choices)
(Circle one number)

Much better now than one year ago……..1
Somewhat better now than one year ago……...2
About the same as one year ago……3
Somewhat worse now than one year ago……..4
Much worse now than one year ago……..5

***Now I'm going to read a list of activities that you might do during a typical day. As read each item, please tell me if your health now limits you a lot, limits you a little, or dows not limit you at all in these activities.**

3a. **First, vigorous activities, such as running, lifting heavy objects, participating in strenuous sports. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little……2
No, not limited at all……...3

3b. **…moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3c. **…lifting or carrying groceries. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3d. **…climbing several flights of stairs. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3e. **…climbing one flight of stairs. Does your health now limit you a lot, limit you a little, or not limit you at all? (**read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3f. **…bending, kneeling, or stooping. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]

(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3g. **…walking more than a mile. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3h. **…walking several hundred yards. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3i. **…walking one hundred yards. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

3j. **…bathing or dressing yourself. Does your health now limit you a lot, limit you a little, or not limit you at all?** (read response choices)

[If respondent says s/he does not do activity, probe: Is that because of your health?]
(circle one number)

Yes, limited a lot……1
Yes, limited a little…….2
No, not limited at all……...3

***The following four questions ask you about your physical health and your daily activities.**

4a. **During the past four weeks, how much of the time have you had to cut down on the amount of time you spent on work or other daily activities as a result of your physical health?** (read response choices)
(circle one number)

All of the time……1
Most of the time…….2
Some of the time……3
A little of the time……...4
Or None of the time……5

4b. **During the past four weeks, how much of the time have you accomplished less than you would like as a result of your physical health?** (read response choices)
(circle one number)

All of the time……1
Most of the time…….2
Some of the time……3
A little of the time……...4
Or None of the time……5

4c. **During the past four weeks, how much of the time were you limited in the kind of work or other regular daily activities you do as a result of your physical health?** (read response choices)
(circle one number)

All of the time……1
Most of the time…….2
Some of the time……3
A little of the time……...4
Or None of the time……5

4d. **During the past four weeks, how much of the time have you had difficulty performing work or other regular daily activities as a result of your physical health, for example, it took extra effort?** (read response choices)
(circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

***The following three questions ask about your emotions and your daily activities.**

5a. **During the past four weeks, how much of the time have you had to cut down the amount of time you spent on work or other regular daily activities as a result of any emotional problems, such as feeling depressed or anxious?** (read response choices)
(circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

5b. **During the past four weeks, how much of the time have you accomplished less than you would like as a result of any emotional problems, such as feeling depressed or anxious?** (read response choices)
(circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

5c. **During the past four weeks, how much of the time did you do work or other regular daily activities less carefully than usual as a result of any emotional problems, such as feeling depressed or anxious?** (read response choices)
(circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

6. **During the past four weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups? Has it interfered…** (read response choices)
(Circle one number)

Not at all……..1
Slightly……2
Moderately……...3
Quite a bit……4
Or Extremely……5

7. **How much bodily pain have you had during the past four weeks? Have you had…** (read response choices)
(Circle one number)

None…..……..1
Very mild……2
Mild……...……...3
Moderate.……4
Or Very severe ……5

8. **During the past four weeks, how much did pain interfere with your normal work, including both work outside the home and housework? Did it interfere…** (read response choices)
(Circle one number)

Not at all……..1
A little bit……2
Moderately……...3
Quite a bit……4
Or Extremely……5

***The next questions are about how you feel and how things have been with you during the past four weeks.**

As I read each statement, please give me the one answer that comes closest to the way you have been feeling; is it all of the time, most of the time, some of the time, a little of the time, or none of the time?

9a. **How much of the time during the past four weeks… did you feel full of life?** (read response choices)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9b. **How much of the time during the past four weeks… have you been very nervous?** (read response choices)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9c. **How much of the time during the past four weeks… have you felt so down in the dumps that nothing could cheer you up?** (read response choices only if necessary)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9d. **How much of the time during the past four weeks… have you felt calm and peacefu?** (read response choices only if necessary)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9e. **How much of the time during the past four weeks… did you have a lot of energy?** (read response choices only if necessary)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9f. **How much of the time during the past four weeks… have you felt downhearted and depressed?** (read response choices only if necessary)

(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9g. **How much of the time during the past four weeks… did you feel worn out?**
(read response choices only if necessary)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9h. **How much of the time during the past four weeks… have you been happy?**
(read response choices only if necessary)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

9i. **How much of the time during the past four weeks… did you feel tired?**
(read response choices only if necessary)
(Circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

***These next questions are about your health and health-related matters.**

Now, I'm going to read a list of statements. After each one, please tell me if it is definitely true, mostly true, mostly false, or definitely false. If you don't know, just tell me.

10. **During the past four weeks, how much of the time has your physical health or emotional problems interfered with your social activities like visiting with friends or relatives? Has it interfered…** (read response choices)
(circle one number)

All of the time……1
Most of the time……2
Some of the time……3
A little of the time……...4
Or None of the time……5

11a. **I seem to get sick a little easier than other people. Would you say that's…**
(read response choices)
(circle one number)

Definitely true……1
Mostly true……2
Don't know……3
Mostly false……...4
Definitely false……5

11b. **I am as healthy as anybody I know. Would you say that's…** (read response choices)
(circle one number)

Definitely true……1
Mostly true……2
Don't know……3
Mostly false……...4
Definitely false……5

11c. **I expect my health to get worse. Would you say that's…** (read response choices)
(circle one number)

Definitely true……1
Mostly true……2
Don't know……3
Mostly false……...4
Definitely false……5

11d. **My health is excellent. Would you say that's…** (read response choices)
(circle one number)

Definitely true……1

Mostly true…….2
Don't know……3
Mostly false……..……...4
Definitely false……5

Appendix H:

Simple Shoulder Test

Simple Shoulder Test

Dominant Hand (circle only one): Right Left Ambidextrous

Shoulder Evaluated (circle only one): Right Left

1.Your shoulder comfortable with your arm at rest by your side?	Yes	No
2. Does your shoulder allow you to sleep comfortably?	Yes	No
3. Can you reach the small of your back to tuck in your shirt with your hand?	Yes	No
4. Can you place your hand behind your head with the elbow straight out to the side?	Yes	No
5. Can you place a coin on a shelf at the level of your shoulder without bending your elbow?	Yes	No
6. Can you lift one pound (a full pint container) to the level of your shoulder without bending your elbow?	Yes	No
7. Can you lift eight pounds (a full gallon container) to the level of your shoulder without bending your elbow?	Yes	No
8. Can you carry twenty pounds at your side with the affected extremity?	Yes	No
9. Do you think you can toss a softball under-hand twenty yards with the affected extremity?	Yes	No
10. Do you think you can toss a softball over-hand twenty yards with the affected extremity?	Yes	No
11. Can you wash the back of your opposite shoulder with the affected extremity?	Yes	No
12. Would your shoulder allow you to work full-time at your regular job?	Yes	No

CURRICULUM VITAE

Jennifer R. Grewe, Ph.D. Candidate, M.S.

PERSONAL INFORMATION

Contact Information: 2370 North 1250 East
North Logan, UT
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Present Position: Doctoral Candidate
Department of Psychology
College of Education
Utah State University

EDUCATION

2005-Current — Doctor of Philosophy: Evaluation and Applied Psychological Science (APA Accredited)
Specialty Track: Health Psychology
Chair: M. Scott DeBerard, Ph.D.
Dissertation: Outcomes of Rotator Cuff Surgery in Utah Workers' Compensation Patients

2005-2010 — Master of Science: Health Psychology
Received en route to Ph.D.
Utah State University
Advisor: M. Scott DeBerard, Ph.D.

1999-2004 — Bachelor of Science: Psychology
Graduated Cum Laude (Upper Division GPA: 3.91)
Minor: Political Science
Utah State University

AREAS OF RESEARCH and PROFESSIONAL INTEREST

- Examining pre-surgical psychosocial variables to predict medical costs and clinical outcomes following surgical interventions.
- Psychological, social, and physical factors related to childhood obesity
- Health promotion program evaluation

RESEARCH EXPERIENCE

Research Assistant- Dr.Scott DeBerard 2010-Ongoing
Utah Workers' Compensation Fund Rotator Cuff Repair Study
Examined the pre surgical biopsychosocial status of Utah workers that underwent rotator cuff repair surgery and post surgical outcomes following rotator cuff repair surgery (e.g.,

physical functioning, quality of life, overall health status, and rates of failure, patient satisfaction, and return to work); and determining whether pre-surgical variables (i.e., patient characteristics, health behaviors, psychosocial variables) are predictive of rotator cuff repair outcome variables.

Program Evaluator- Holly Budge, Health Promotion Deputy Director 2008-2009
Bear River Health Department Obesity Prevention Project
Organized and analyzed large data files for presentation to Bear River Obesity Coalition. Data analysis highlighted areas of the population that needed health promotion program implemented. Helped implement health education program to local middle school students. Coalition members consisted of local community leaders, principals, and local hospital personal.

Research Assistant-Dr. Scott DeBerard 2007-2009
Examined the utility of the MMPI-2 in predicting patient outcomes and malingering status by analyzing extinct data files. A cluster analysis was applied to the data and results were reported and presented to masters thesis committee.

Research Coordinator- Dr. Tamara Ferguson 2004-2007
Utah State University
Edith Bowen Arts Evaluation Project
Coordinated research efforts of undergraduate students on the Edith Bowen Arts Evaluation project. Responsibilities included implementing the biannual EBLS data collection at an elementary school and local middle and high schools. The project involved oversight of student training, material preparation, and coordinating schedules; data coding and entry, longitudinal data analyses, and preparation on annual evaluation report.

Research Coordinator- Dr. Tamara Ferguson 2004-2007
Utah State University
Adaptive and Maladaptive Functions of Negative Emotions Project
Organized student volunteers on a large-scale study of the adaptive and maladaptive functions of negative emotions. The maladaptive emotions study involved coordinating, training, and day-to-day oversight of a team of undergraduate research apprentices who learned to reliably code and enter the data for almost 1,000 written diaries concerning negative emotions.

Research-Dr. Ferguson, Dr. Gilbertson, Dr. Domenech-Rodriguez 2004-2005
Utah State University
Mount Logan Middle School Bully Intervention Project
Implemented the "empowering the victims of bullying" program by teaching the intervention in the classrooms, helped with creating intervention exercises.

HONORS & RECOGNITIONS

Travel Award 2008- 2010 Utah State University
Awarded 2005 Outstanding Recent Graduate College of Education, Utah State University
Graduated cum laude 2004 Utah State University
2004 Rocky Mountain Psychological Association paper award recipient
Awarded 3rd place at Utah State Psi Chi poster presentation conference

PROFESSIONAL SOCIETIES

Psi Chi National Honor Society
Western Psychological Association (WPA) student member
Society of Behavioral Medicine (SBM) student member, Special Interest Group membership (Physical Activity, Pain and Student)

PROFESSIONAL SERVICE

Consultant for Utah State University Women's Basketball Team (2010- ongoing)
Board member of Bear River Obesity Prevention Coalition 2009-2010
Grant writing assistance for Bear River Health Department, Health Promotion

TEACHING EXPERIENCE

Instructor-Scientific thinking and methods in psychology 2010
Utah State University, Logan
Currently teach the research and methodological design course for advanced psychology undergraduate students. Non experimental and experimental research designs are discussed and students develop a research proposal over the course of the semester.

Guest Lecturer-Introduction to program evaluation 2009
Utah State University, Logan
Guest lecturer on the topics of sampling designs, probability and non-probability sampling, and survey/questionnaire development.

Online Teaching Assistant-Dr. Bates: Research Methods in Psychology 2009
Graduate teaching assistant for undergraduate online course in scientific research methods and the application of research methods to psychology. Regularly communicated with students via email and provided feedback on various assignments and exams.

Teaching Assistant-Dr. Friedman, Research in Psychology 2009
Graduate research methods course, create, administer, and grade all quizzes and exams in the course. Regularly meet with students during scheduled office hours.

Instructor Broadcast/Online Course-Scientific thinking and methods 2008
Utah State University, Logan
Taught eighteen students about research and methodological design in psychology. All lecture material was broadcast to USU satellite locations throughout Utah.

Teaching Assistant-Dr. Ferguson: Introduction to Psychology 2008
Utah State University, Logan
Assisted professor by lecturing, resolving student questions/concerns, and overseeing the lab portion of the class including preparing the assignments, and lecturing in labs.

Teaching Assistant- Dr. Gordin: Mental Aspects of Sports Performance 2005
Utah State University, Logan
Handled various administrative duties including grading class assignments, resolved student questions regarding course material, and lectured on assigned topics.

RELEVANT WORK EXPERIENCE

Pilates/Personal training Program Director- Sports Academy 2005-2010
Implemented health programs, regularly assessed community needs, supervised daily operations, employee hiring, and instructor education. Organized day to day training schedule and held regular meetings with members of department.

SCHOLARLY WORKS

Grewe, J. & DeBerard, M. S. (2010). Prevalence of obesity in local communities. Poster presented at the Society of Behavioral Medicine. Seattle, WA.

Grewe, J., DeBerard, M. S., & Bates, S. (2009). Utility of the MMPI in detecting malingering in compensated back pain patients: An analog study. Poster presented at the annual meeting of the Western Psychological Association, Portland, OR.

DeBerard, M. S., Gundy, J., Doti, J., **Grewe, J.,** & LaCaille, R. (2009). The use of retrospective cohort studies in behavioral medicine research. Poster presented at the annual meeting of the Society of Behavioral Medicine, Montreal, Canada.

Grewe, J. (2009). Detecting malingering in compensated back pain patients. An analog study. (thesis project).

Grewe, J. & Thurgood, L. (2008). Valuing and evaluation: steps to a framework in support of effective evaluation policy. Paper presented at the American Evaluation Association, Denver, CO.

DeBerard, M. S., Masters, K. S., Bates, S. & **Grewe, J**. (2008). *Detecting malingering in compensated back pain patients: An analog study.* Poster presented at the Annual meeting of the Society of Behavioral Medicine, San Diego, CA.

DeBerard, M. S., LaCaille, R., Spielman, G., Parlin, M., Gundy, J., & **Grewe, J**. (2008). *Patient satisfaction with the Utah Workers? Compensation system following lumbar discectomy: A validity study.* Poster presented at the Annual meeting of the Society of Behavioral Medicine, San Diego, CA.

Ferguson, T. J., Brugman, D., **White, J**., & Eyre, H. (2007). Shame and guilt as morally warranted experiences. In J. L. Tracy, R. W. Robins, & J. P. Tangney (Eds.), *The Self-Conscious Emotions: Theory and Research*. Guilford Press.

Weaver, S., & Miller, M. (2005). *Victims' perceptions of responsibility and perpetrators' guilty feelings: The eye of the beholders*. Paper submission to the Rocky Mountain Psychological Association, Reno, Nevada (Supervisors: Tamara J. Ferguson and **Jennifer White**).

White, J. (2004, April). *Madness to methods and purpose in pain: Studying the beneficial and adverse consequences of shame and guilt*. Paper presented at the Rocky Mountain Psychological Association, Reno, Nevada ($500 "top student presentation" award).

Ferguson, T. J., Suzuki, E., Turcin, I, & **White, J**. (2003, July). *Findings of the Edith Bowen School Arts Curricula Evaluation Project: Annual Report for Fall 2002 – Spring 2003*. Utah State University Technical Report.