Certified Athletic Trainer's Treatment of Low Back Pain and Utilization of Chiropractic Services

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Abstract

BACKGROUND: Low back pain is a common injury among athletes. The management of this disability is as ambiguous as its diagnosis, with no universally accepted treatment. The purpose of this study was to evaluate collegiate certified athletic trainer's (ATC) treatment of low back pain and their utilization of chiropractic services. METHODS: Surveys were emailed to 500 collegiate ATCs, yielding 151 responses. RESULTS: The majority (46.6%) selected core strengthening/stabilization as their number one preferred method of low back pain treatment. About half (49.7%) reported an ATC or staff performed lumbar joint mobilizations, where 52.3% stated their institution had a chiropractor as part of their staff. Seventy-seven percent of the reporting institutions have referred an athlete with low back pain to a chiropractor. CONCLUSION: Core strengthening/stabilization was the number one preferred treatment of low back pain. There is also significant involvement of chiropractors in the treatment of low back pain in collegiate athletics.

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Introduction

There are a plethora of injuries that cause dysfunction in the lumbar spine and most can create the symptom of low back pain (Bono, 2004). Low back pain is often not associated with an identified structural or anatomical injury. Given that athletes place greater demands on their musculoskeletal system, low back pain is a common occurrence presenting limitations to athletes in their respective sports (Baker & Patel, 2005). Low back pain prevalence among athletes is reported as high as 75% (Stump & Redwood, 2002). The greatest prevalence occurs in sports such as football, wrestling and gymnastics. These sports involve dynamic movements and place high stress on the lumbar spine and surrounding structures (Baker & Patel, 2005). For example, there have been reports of up to 50% of football linemen receiving treatment for low back pain during one season (Stump & Redwood, 2002). Also, in wrestling, there is a reported 59% lifetime occurrence of low back pain, compared to 31% of their age-matched peers (Bono, 2004).

Collegiate athletes are individuals who need to return from an injury as quickly as possible. Certified athletic trainers (ATC) and sports medicine physicians are medical professionals that must treat these individuals effectively and efficiently while maintaining the safety of the athlete. Returning the athlete to the field in a timely fashion is important to the coaches, the athlete and the overall success of the team. Low back pain is also an economic problem in the general population in society (Baker & Patel, 2005). The yearly cost of low back pain and associated complications in the U.S. has been

estimated at being around $100-$200 billion in health care costs and wages lost (Baker & Patel, 2005). With the current health care economics in the U.S., a more efficient method of treating low back pain among the general public may help save money in the treatment of low back pain. Understanding the most effective treatment in the athletic population related to back pain might reveal additional strategies for the general population.

One purpose of the following study is to determine the most used method of treatment for low back pain among NCAA Division I ATCs. There is no defined or standard method for treating low back pain between ATCs due to the complexity of low back pain as both a symptom and an injury. If common methods of treatment are defined or quantified, medical professionals can aim more research in these areas resulting in better clinical practice.

Another intention of this study is to determine the use of chiropractors among collegiate athletes and ATCs. Chiropractors are most known for treating back ailments through spinal manipulation. The use of spinal manipulations has been well documented in the treatment of low back pain. Chiropractic medicine focuses on the treatment of musculoskeletal injuries, and there has been an increase in demand for their services by athletes. The role and prevalence of chiropractic use has been documented in professional sports, however there is no known study that has determined their role at the collegiate level. It is the purpose of this study to determine the prevalence of chiropractor use among collegiate athletes and their role in the treatment of athletic low back pain.

Therefore, the overall purpose of this study is to determine ATC's treatment preference of low back pain as well as indentify the role of chiropractic use among

collegiate athletes. It is hypothesized that there is no typical protocol for treatment of low back pain between these ATC's and that chiropractors are commonly utilized for the treatment of low back pain among collegiate athletes.

Literature Review

Method of Review

For the purpose of this review, the University of Minnesota's online library database was utilized. The following search terms were used to yield relevant literature: "low back pain in athletes"; "treatment of low back pain in athletes"; "chiropractic use by athletes"; "athletic trainer's treatment of low back pain"; "athletic trainers and chiropractors."

Due to the paucity of appropriate articles pertaining to athletes, the term athlete was removed from the search terms. Articles involving treatment of low back pain by physical therapists were also included. Overall, the investigation of this topic revealed a lack of cohesive and suitable literature. However, the articles were sorted into relevant topics in order to satisfy the purpose of this research. The topics were as follows: low back pain in athletes, treatment of low back pain and chiropractic use by athletes.

Low Back Pain

Low back pain is a symptom, not a diagnosis or specific injury (Battle, Cherkin, Dunn, Cloi & Wheeler,1994; Bono, 2004; Herbert, Koppenhaver, Fritz & Parent, 2008). Low back pain can develop from a specific injured tissue or from an idiopathic nature. The identification of a specific cause of low back pain may be "indefinable," as described

in the literature (Kolber & Beekhuizen, 2007). The most common causes of low back pain are as follows: disc disease, muscle strain, vertebral bone injury, non-specified, and psychosomatic (Baker & Patel, 2005; Battle, 1994; Bono, 2004).

Most of the literature concludes that low back pain, and associated injuries, occurs from an increase of physical demands that are placed on the spine (Baker et al., 2005; Battle et al., 1994; Bono, 2004). Repetitive loading of the spine, as in weight lifting and sport activity, increase the chances of developing low back pain (Baker et al., 2005; Battle et al., 1994; Bono, 2004; Ong, Anderson & Roche, 2003). Athletes must also maintain core stability during bouts of elite dynamic and extremely loaded movements (Hibbs, Thompson, French, Wrigley & Spears, 2008). Due to these findings, athletes potentially have a greater risk for developing low back pain than the general population. Many sports include a physical component of repetitive loading, repetitive flexion and hyperextension, which can lead to an injury to the lumbar spine or low back pain in particular (Baker et al., 2005; Battle et al, 1994; Bono, 2004). Sports that frequently put athletes through these motions include, but are not limited to; football, ice hockey, wrestling, gymnastics, swimming and golf.

In athletics, there are several risk factors and predictors of developing low back pain. The greatest predictor of developing low back pain found in athletes is a history of low back pain itself (Baker et al., 2005; Bono, 2004). If an athlete has had an episode of low back pain, they are six times as likely to have a recurrent episode at some point in their life (Baker & Patel, 2005). Athletic equipment has also been shown to play a role in low back pain (Bono, 2004). For cyclists and horse jockeys, bicycle seats and saddles

must be engineered to maintain proper back posture (Bono, 2004). Footwear also plays an important role in transmitting forces in the lumber spine and paraspinal musculature (Bono, 2004).

Although flexibility is often times referred to in discussing causes of low back pain, there has been limited research to support the correlation between a decrease in range of motion and low back pain (Baker & Patel, 2005). In fact, research has suggested that flexibility of the lower extremity and trunk have no correlation with low back pain (Baker & Patel, 2005). Hamstring tightness, however, usually is an associated finding in patients diagnosed with a spondyloysis (Baker & Patel, 2005). Along with hyperlordosis, tightness in the hamstring musculature will rotate the pelvis posterior limiting the trunk's forward flexion (Baker & Patel, 2005). This hyper-extended posture has been implicated in the development of spondylolysis, and therefore low back pain (Baker & Patel, 2005). Flexibility can also have an effect on latency times in muscle responses (Cholewicki et al., 2005). In one research study, it was concluded that individuals sustaining low back injury, on average, had a muscle latency that was 14 milliseconds longer than those not sustaining an injury (Cholewicki et al., 2005).

Prevalence of Low Back Pain Among Athletes

The symptom of low back pain can be a result of many different injuries. Athletes, as compared to other individuals, have been reported to have a higher prevalence of low back pain (Baker et al., 2005; Bono, 2004; Cholewicki et al., 2005; Gerbino & d'hemecourt, 2002; Hangai et al., 2009; Iwamoto, Abe, Tsukimura & Wakano, 2004; Ong et al., 2003; Stewart, 2009; Stump, 2002). The intense weightlifting

and higher level of increased demands may lead to many injuries generating low back pain, as well as the unspecified pain in the lumbar spine (Baker, 2005; Bono, 2004; Gerbino, 2002). The research suggests that up to 75% of all athletes will experience some sort of low back pain in their life compared to only 31% in individuals deemed as non-athletes (Baker et al., 2005; Ong et al., 2003; Stump et al., 2002).

There is some debate in the research over which sports cause a greater risk of low back pain. Bono (2004) performed a systematic review of low back pain in athletes and determined wrestling as having the highest prevalence at 59%. However, Hangai et al. (2009) reports swimming as the most prevalent sport causing low back pain, while others argue that football has the highest rate of low back pain (Iwamoto et al., 2004; Stump et al., 2002).

The majority of researchers agree on making the statement that athletes have a greater risk of developing low back pain than the normal population (Baker et al., 2005; Bono, 2004; Cholewicki et al., 2005; Gerbino et al., 2002; Hangai et al., 2009; Iwamoto et al., 2004; Ong et al., 2003; Stewart, Stanton, Wilson & Hides, 2009; Stump et al., 2002). Bono (2004) reported a 59% prevalence rate in wrestlers compared to an age matched control, which only reported a rate of 31%. Also reported were 79% of elite gymnasts developing low back pain, as compared to their age group control at 38%. Adolescent athletes followed the same trend with 46% of adolescent athletes developing pain in their lower back compared to 18% of non-athletes of the same age.

In the 2000 Sydney Olympics, 31 elite athletes presented with low back pain, 62% of which was due to disc degeneration (Ong et al., 2003). Ninety percent of all

injuries occurring in the Professional Golfer's Association Tour (PGA Tour) were reported as involving either neck or low back (Bono, 2004). Thirty-eight percent of professional tennis players that missed one or more tournaments in a season blamed their miss on low back pain (Hagins, Adler, Cash, Daugherty & Mitrani , 1999).

Football specifically has been under the microscope regarding all injuries, not just low back pain. Low back pain episodes in football players have been studied due to its popularity, explosive nature and high impact forces. One research study observed 913 collegiate and high school football players and found that low back pain was present in 54.1% of all high school football players and 49.4% of the collegiate athletes (Iwamoto et al., 2004). Of these cases, about 10.5% were related to spondylolysis, which was determined to be the most significant risk factor of low back pain in high school and collegiate level football players (Iwamoto et al., 2004). Another study looked at all down lineman participating at a specific NCAA Division I University and found that half (50%) sought treatment for low back pain (Stump & Redwood, 2002). It is also reported that 27% of all collegiate football players will develop some form of low back pain in their career with the risk increasing as the number of years they participate increases (Stump & Redwood, 2002). Another study found 30% of 144 surveyed collegiate football players had developed low back pain at some point in their career (Baker & Patel, 2005). Semon and Spengler (1981) researched 506 football players over an 8-year span. They found that 135 (27%) suffered from low back pain during their playing careers.

Certified Athletic Trainers (ATC) of National Football League (NFL) teams recognize that low back pain is an issue among football players (Stump & Redwood,

2002). Thirty-seven percent of NFL ATCs report a low back pain prevalence rate at 20% or greater and agree that it is a common occurrence in the sport of football (Stump & Redwood, 2002) Also, 59% of NFL ATCs agree that low back pain commonly results in early retirement of professional football players (Stump & Redwood, 2002).

Typical Injuries Causing Low Back Pain in Athletes

Mechanical low back pain.

Mechanical low back pain is a term used to couple together lumbar ligamentous sprains, muscle strains and deficits in strength and coordination (Baker et al., 2005; Bono, 2004; Kolber et al., 2007). Research has determined that mechanical low back pain is the most common cause of low pack pain in athletes, with 59% of these cases being acute (Baker et al., 2005; Bono, 2004; Kolber et al., 2007). Causes of this dysfunction are thought to result from overstress of anatomical structures, poor technique of athletic movements, muscular imbalances and/or poor footwear. Patients that have mechanical low back pain, especially chronic pain, may undergo many diagnostic radiographs, such as magnetic resonance imaging (MRI) and x-ray, which typically can show no significant abnormalities. When most athletes or patients are diagnosed with mechanical low back pain, there is typically no determination of a specific injury or damaged structure that is causing the generation of this pain (Baker et al., 2005; Bono, 2004).

Treatment of this injury seems to be just as complicated as its diagnosis (Baker, 2005; Bono, 2004). Currently, there is minimal literature or clinical evidence that reports the effectiveness of a rehabilitation protocol to the lumbar spine (Baker et al., 2005;

Bono, 2004). There is also inconclusive evidence that formal rehabilitation programs improve recovery from mechanical low back pain. Most of the literature recommends a gradual return to activity through rest, non-steroidal anti-inflammatory medication, stretching and core muscle strengthening. Altering extrinsic factors, such as poor technique and improper footwear may help in a current episode of low back pain and also could help eliminate recurrence of the dysfunction (Baker & Patel, 2005).

More recent research has attempted to determine exact musculature structures that are involved in episodes of mechanical low back pain (Hides, Stanton, Freke, Wilson, McMahon & Richardson, 2007 & Hides, Stanton, McMahon, Sims & Richardson, 2008). Hides et al. (2007) found through diagnostic ultrasound that there was asymmetry between quadratus lumborum muscles in athletes with current low back pain. These athletes also had a reduced ability to draw in their abdominal wall and contract their transverse abdominalis (TrA). Hides, Stanton, McMahon, Sims and Richardson (2008) showed patients with low back pain had a decreased cross sectional area of the multifidus muscle and TrA decreased in patients with low back pain. The research attributed this decrease in size to muscle atrophy. Therefore, specific training of these muscles has been recommended. Many researchers suggest that a preseason trunk/core-strengthening program will prevent mechanical low back pain in athletes (Baker, 2005; Battle, 1994; Bono, 2004; Durall, Udermann, Johansen, Gibson, Reineke & Reuteman, 2008; Hides, 2007; Hides 2008; Nadler 2002).

Disc pathology.

Degenerative disc disease, disc pathology and herniated/slipped disc are all terms relating to an injury of an intervertebral disc of the spinal column (Baker et al., 2005; Bono, 2004; Iwamoto, Takeda, Sato & Wakano, 2006). An intervertebral disc is a fibro-cartilaginous structure that lies between two vertebrae (Baker et al., 2005; Bono, 2004; Iwamoto et al., 2006). A disc consists of an outer layer of fibrocartilage called the annulus fibrosis. The annulus fibrosis surrounds a suspended gel substance called the nucleus pulposus. The disc, in whole, acts as a shock absorber between the two vertebrae while allowing movement at the joint (Baker et al., 2005; Bono, 2004; Gerbino et al., 2002; Hangai et al., 2009; Iwamoto et al., 2006; Ong et al., 2003).

A disc herniation, or injury to the intervertebral disc, occurs when material from the nucleus pulposus emerges into the annulus fibrosis, and protrudes from its original boundaries (Baker et al., 2005; Bono, 2004). There are three main forms of disc herniations. Protrusion: occurs when the nucleus pulposus extends past its normal form and takes up space within the annulus fibrosis. Extrusion: occurs when the nucleus protrudes through the walls of the annulus fibrosis to extend into the spinal column. Sequestration: occurs when part of the nucleus pulposus protrudes past the annulus fibrosis, enters the spinal canal, and breaks off becoming free floating (Baker et al., 2005; Bono, 2004).

Magnetic Resonance Imaging (MRI) is the most sensitive noninvasive diagnostic test for disc pathology (Ong, Anderson & Roche, 2003). An MRI determines the hydration status of the disc, through a loss of disc signal intensity, which is measured

through the loss of water from the nucleus pulposus (Iwamoto et al., 2006; Ong et al., 2003). An MRI can also clearly identify the disc height by giving a visual image of the disc itself (Baker et al., 2005; Bono, 2004; Iwamoto et al., 2006; Ong et al., 2003). Not only is MRI used in the diagnosis of disc injuries, it is the standard diagnostic tool in determining all injuries to the lumbar spine (Baker et al., 2005; Bono, 2004). It is also worth note that through an MRI, it has been demonstrated that disc signal progressively decreases from cervical to lumbar spine, with L5-S1 being the most affected by disc degeneration (Baker, 2005; Bono, 2004).

Disc herniations are a common cause of back pain, and have been seen to generate leg numbness and weakness in athletes (Baker, 2005; Hangai, 2009; Iwamoto, 2006). Weight lifting techniques, as well as other athletic activities, place an increased amount of stress on discs, which are meant to act as shock absorbers between the vertebrae (Baker et al., 2005; Bono, 2004; Iwamoto et al., 2006; Ong et al., 2003). One study recognized that weightlifting, accompanied by the violent hyperextension movements engrossed in the sport of football, increases the risk of degenerative disc disease (Gerbino & d'Hemecourt, 2002). The research also indicates that as years of participation increase, so does the risk of developing disc pathology (Gerbino & d'Hemecourt, 2002). In the 2000 Sydney Olympics, 62% of all athletes who presented with low back pain had developed disc degeneration. Of the 62%, 36% were diagnosed with what was defined as grade-three disc pathology (Ong et al., 2003).

Spondylolysis.

Another common injury to the lumbar spine and cause of low back pain is a spondyloysis. A spondylolysis is a bony defect within the neural arch of a vertebra (Baker et al., 2005; Bono, 2004). This defect occurs in the area of the vertebra known as the pars interarticularis (posterior area of vertebra that connects facet joints) and can also be known as a Scotty dog fracture (Baker et al., 2005; Bono, 2004; Iwamoto et al., 2004). A spondylolysis injury most commonly occurs in the lumbar region, affecting L5 85-95% of the time (Bono, 2004). Common methods used in diagnosing a spondyloysis include a plain radiograph x-ray, MRI and computed tomography (CT) (Thein-Nissenbaum & Boissonnautt, 2005).

The cause of most spondyloysis injuries is overloading of the pars interarticularis through extreme loads or repetitive hyperextension (Baker, 2005; Bono, 2004). These mechanisms are found rampant through sports such as gymnastics, wrestling and football (Baker et al., 2005; Bono, 2004; Iwamoto et al., 2004; Semon et al., 1981). In the general public, the prevalence of spondyloysis is approximately 5% compared to 8-15% in the athletic population (Baker et al., 2005; Bono, 2004). Different sports and positions have been determined to have more risk than others (Baker et al., 2005; Bono, 2004). Gymnastics, with its highly repetitive movements has a prevalence of 11-17% (Bono, 2004). Up to 33% of all football linemen are reported to have a spondylolysis, and the prevalence among competitive weight lifters is around 23-36% (Bono, 2004).

A review of 135 collegiate football players' medical records found that 11.5% were diagnosed with a spondylolysis by diagnostic imaging (Semon & Spengler, 1981).

Other research has shown that spondylolysis is the most significant risk factor for developing low back pain in college and high school football players (Iwamoto, Abe, Tsukimura & Wakano, 2004). There was no significant difference in time loss between players who had back pain with a spondylolysis and players who had back pain with no accompanying spondylolysis (Iwamoto et al., 2004).

Common Treatments Used for Low Back Pain

Currently, the research lists a plethora of techniques that health care professionals can use to treat the symptom of low back pain (Baker et al., 2005; Battle et al., 1994; Bono, 2004; Iwamoto, et al. 2006; Johnson, Lewis-Priestly & Johnson, 2008; Nichols & Harrigan, 2006; Pollard & Hoskins, 2006; Sullivan, Kues & Mayhew, 1996). This creates a problem for developing a set treatment protocol as well as a lack of efficiency from a single treatment technique. For the purpose of this research, the treatment of the low back pain as a symptom will be reviewed, as opposed to specific injuries. All treatments will be discussed, however, more emphasis will be placed on the treatment of the symptom as opposed to the disorder. Another factor worth noting is that there is limited research documenting protocols or effectiveness of low back pain treatment among athletes. Kolber et al., 2007, even states that indentifying a cause of low back pain can be "indefinable," and stresses the quest for valid methods in low back pain diagnosis and treatment remains research priorities.

Sullivan, Kues and Mayhew (1996) determined a total of 28 treatments used frequently (>50% response) by surveyed physical therapists (PT) about the treatment of low back pain. The researchers were able to merge these 28 treatments into the following

seven categories: McKenzie method, manual therapy, exercises with equipment, active and stretching exercise, physical agents/modalities, aerobic exercise and walking, and ergonomic activities (Sullivan, Kues & Mayhew, 1996). The McKenzie method incorporated stabilization and postural exercises including core strengthening and stabilization. Manual therapy encompassed spinal manipulations, massage and muscle energy techniques. The active and stretching exercise category focused on assisted and unassisted stretching and isometric exercises for trunk musculature (Sullivan et al., 1996). The category listed as exercise with equipment included all aerobic and resistance training while the aerobic exercise and walking category only included home programs. The physical agent category included modalities such as ultrasound and transcutaneous electrical stimulation. This category also included medicinal interventions such as corticosteroid injections and non-steroidal anti-inflammatory medications. The ergonomic activity category focused on activities of daily living and physical demonstrations of ergonomic principles (Sullivan, et al., 1996).

Battle, Cherkin, Dunn, Cloi and Wheeler (1994) also assessed prevalence of low back pain and treatments used by PTs. This survey reported that 45% of all treated patients suffered from low back pain. Among treatments used for low back pain, the McKenzie method was the most commonly utilized treatment between health care professionals. This study, along with a few others, concluded that more research is needed in order to identify the most effective treatment for low back pain (Baker et al., 2005; Battle et al., 1994; Bono, 2004; Iwamoto et al., 2004; Sullivan et al., 1996).

The difficulty in reviewing these treatment articles lies with the notion that they do not incorporate athletes into their models (Battle et al., 1994; Iwamoto et al., 2004; Sullivan et al., 1996). The athletic population needs to return from injury quickly in order to resume athletic competition. A better understanding of an athletic treatment approach to low back pain may be beneficial to the general public and aiding them in a swift return from pain.

The following sections will discuss common treatments of low back pain with an in-depth look at chiropractic use among athletes.

Core Strengthening/Stabilization.

The treatment approach of core strengthening and stabilization relies on the fact that low back pain is typically caused by strength and coordination deficit in lumbar stabilizing musculature (Kolber et al., 2007). This deficit can also lead to inefficient technique predisposing an athlete to injury (Hibbs et al., 2008). The research indicates that in an episode of low back pain, static stabilizers such as ligament and bone are insufficient for core stabilization (Kolber et al., 2007). The musculature surrounding the area must satisfy the need for stabilization, however is usually inhibited in patients with low back pain (Kolber et al., 2007). The goal of this treatment is therefore to strengthen weakened muscles and restore coordination and movement patterns. Specifically, the literature directs clinicians to target specific musculature including the TrA, multifidus and spinal extensors (Hibbs et al., 2008; Kolber et al, 2007). Core strengthening/stabilization is usually performed as a progression of multiple exercises that usually aim at spinal extensors, such as the prone push-up, supine abdominal draw,

quadruped, bridging exercises, etc. (Kolber et al., 2007; Ross, 2007). Research also states that spinal extensor weakness, as opposed to spinal flexors, increases the risk of developing low back pain (Kolber et al., 2007).

Core strengthening and stabilization can also be used as a preventative measure against low back pain (Durall, Udermann, Johansen, Gibson, Reineke & Reuteman, 2009; Hibbs et al., 2008; Kolber et al., 2007). Durall et al. (2009) evaluated low back pain occurrence in women's gymnastics. Through a biweekly, 10 week protocol, 15 female gymnasts saw a significant increase is trunk musculature endurance as measured by four valid, static hold tests: Biering-Sorensen trunk extensor test, trunk flexor test and right and left lateral side bridge tests. Among these athletes, there were no new episodes of low back pain.

Manual Therapy.

For the purpose of this review, the broad umbrella of manual therapy treatment is categorized as active release technique (ART), muscle energy techniques (MET) and Graston technique (GT). These treatments were meant to incorporate a "hands-on" approach. Although manipulations are technically manual therapy, they were separated into the category of chiropractic medicine. The above stated techniques, and many others under this category, are thought to lengthen and strengthen muscles, decrease edema and mobilize restricted articulations (Wilson, Payton, Dongen-Shoat & Dec, 2003). ART is a soft tissue manipulation in which the clinician uses the patient's active motion while providing pressure onto the treatment area. This treatment is theorized to release scar tissue or entrapped nerves and blood vessels (Swann & Granner, 2002). This technique is

only to be performed by a properly trained clinician, one who understands the sensitive palpation techniques of anatomical structures.

Muscle energy techniques (MET), like ART, can only be performed by properly trained clinicians and utilize voluntary contractions by the patient to provide greater range of motion to the target area. METs must be performed in a precise direction with varying levels of intensity with an appropriate counterforce applied by the clinician. (Swann et al., 2002; Wilson et al., 2003). This therapy uses these isometric contractions and corrective force to restore alignment along the spine. Wilson et al., 2003, found that people who underwent MET treatment for low back pain had a statistically greater improvement on their Oswestry Disability index score when compared to resistance training and neuromuscular re-education. The authors concluded that MET coupled with other active resistance training, such as core stabilization, might be more efficient in restoring normal function than active resistance training alone.

The Graston technique (GT) is a type of massage therapy that consists of a number of hand-held stainless steel instruments. These instruments are claimed to act as tuning forks by resonating in the clinicians hand, allowing adhesions and restrictions to be isolated and target (Crothers, Walker & French, 2008). GT is gaining worldwide popularity as a treatment to many soft tissue disorders. There is limited research on the effectiveness of this treatment, however it has improved nerve conduction latencies, wrist strength and wrist motion in patients with carpal tunnel syndrome when compared to soft tissue mobilizations performed by the clinician's hand (Crothers et al., 2008).

McKenzie Method.

The McKenzie method is a treatment protocol used mainly by physical therapists to treat patients with low back pain (Battle et al., 1994; Busanich & Verscheure, 2006; Miller, Schenk, Karnes & Rousselle, 2005; Sullivan et al., 1996). This specific treatment bases its methods off the understanding that certain tissues, such as paraspinal musculature, spinal joint articulations, intervertebral discs, etc., do not dissipate mechanical forces properly (Busanich & Verscheure, 2006). This leads to injury of these tissues, and if uncorrected, dysfunction will persist (Busanich et al., 2006; Miller et al., 2005). There are three mechanical syndromes determined by this theory; postural theory, dysfunction theory and derangement theory (Busanich & Verscheure, 2006). Each syndrome has a distinct approach to a diagnosis and treatment that is utilized by the physical therapist. This treatment highlights education and active patient involvement in the management of their treatment (Battle et al, 1994; Busanich et al., 2006; Miller et al., 2005). The method is thought to decrease pain quickly, and restore function and independence to the individual (Battle et al., 1994; Busanich et al., 2006; Miller et al., 2005). In 1994, the McKenzie method was deemed the most utilized treatment among physical therapists in the treatment of low back pain (Battle et al., 1994).

Much of the research reporting the effectiveness of McKenzie method in the treatment of low back pain compares it to other treatment protocols (Baker et al., 2005; Battle et al., 1994; Busanich et al., 2006; Miller et al., 2005; Sullivan et al., 1996). In the normal population, the McKenzie method has shown a short term decrease in pain and disability when compared to non-steroidal anti-inflammatory medications, back massage,

strength training and general mobility exercises (Busanich & Verscheure, 2006). There was no statistical difference, however, between these treatments and their immediate and long-term effects (Busanich & Verscheure, 2006). In contradiction, Miller et al. (2005) reported no statistical difference between the McKenzie treatment and other exercises utilized to treat low back pain. The McKenzie method has been used in a clinical setting for many years now, however, its effectiveness and use has rarely been determined in an athletic setting (Busanich & Verscheure, 2006). Most of the research involved physical therapy settings, and although can treat athletes, has no definite implications in the treatment of athletes with low back pain (Battle et al., 1994; Miller et al., 2005; Sullivan et al., 1996).

Epidural injections.

Low back pain is most commonly treated with a conservative approach to relieve pain and increase functionality (Baker et al., 2005; Battle et al., 1994; Bono, 2004; Busanich et al., 2006; Miller et al., 2005). Some conditions may require surgery, however, there are other methods to treat non-surgical conditions that are not progressing from conservative treatment (Baker et al., 2005; Bono, 2004; Peterson & Hodler, 2009). Typically, a physician will inject a local anesthetic and a corticosteroid into the joint or area of discomfort to help alleviate low back pain (Baker at al., 2005; Bono, 2004; Peterson et al., 2009). The corticosteroid is thought to target and eliminate the inflammation in the area under pain and discomfort (Baker et al., 2005; Bono, 2004; Peterson et al., 2009). The short-term evidence of these injections has been shown to be strong, however there is lack of support for moderate to long-term effects (Baker et al.,

2005; Peterson et al., 2009). Effectiveness also can depend on the specific injury (Baker et al., 2005; Bono, 2004). Injections are more successful when a herniated disk protrudes laterally and into or near the foramina (Bono, 2004; Peterson et al., 2009). Sacroiliac joint dysfunctions can also be a cause of low back pain; however there is limited research on the effectiveness of injections for this injury (Peterson & Hodler, 2009). Although injections are another treatment used, their long-term effectiveness is undetermined and more research is needed in this area (Baker et al., 2005; Bono, 2004; Peterson et al., 2009).

Chiropractic treatment.

Chiropractic medicine is a common treatment used in the correction of low back pain. Doctors of Chiropractic medicine utilize manipulations and soft tissue massage in order to correct misalignments and nervous system malfunctions within the muscle. Although there is a perception that medical professionals are skeptical of chiropractors, they still utilize their services that have positive outcomes in research.

Common symptoms of low back pain include lumbar pain and stiffness. Research has shown that through specialized techniques, chiropractors can relieve these symptoms and help the patient to become more functional. Colloca and Keller (2001) reported that posteroanterior thrusts performed to the lumbar spine decreased stiffness and had a beneficial effect on the neuromuscular reflex response in patients with low back pain. In 2006, Colloca and colleagues showed short duration and high velocity manipulations had positive neuromechanical and physiologic effects that helped to restore pain free movement and decrease disability.

Other research has reproduced the findings that chiropractic medicine can be beneficial in the treatment of low back pain. Hanhrahan, Van Lunen, Tamburello and Walker (2005) showed that joint mobilizations performed on the lumbar spine were beneficial for low back pain patients through its stimulation of joint mechanoreceptors. This study theorized that through the inhibition of hypertonic muscles, the mechanoreceptors drove the pain-spasm cycle. Compared to a control group, Hanrahan et al. (2005) showed that first and second grade joint mobilizations produced a significant decrease in pain at rest and during lumbar extension while producing an increase in force production of the trunk musculature. Ernst (2003) also determined that both high and low velocity thrusts utilized during spinal manipulations were beneficial to the patient.

Chiropractic medicine has also been shown to be valuable in the prevention of low back pain. In one article, both joint manipulations and soft tissue based treatments were performed to asymptomatic regions. Common areas treated were the spinal column, gluteal musculature, hamstrings and hip flexors. A preventative effect was seen to hamstring injuries with athletes receiving preventative soft tissue treatment (Pollard & Hoskins, 2006).

Chiropractor's role in sports medicine and use among athletes.

The prevalence of low back pain in athletes, as stated earlier, remains very high. An athlete's lower spine must perform challenging and demanding tasks, which put the lumbar area under added stress (Baker et al., 2005; Bono, 2004). There are many generators of low back pain such as degenerative disc disease and spondylolysis, however a specific reason for the pain cannot always be located (Bono, 2003). This

leaves medical professionals to only treat the symptom of low back pain as opposed to a specific injury diagnosis (Bono, 2003).

Chiropractic medicine, in most settings, has been used to treat this symptom among both athletes and the general public (Bono, 2003; Crothers, Walker & French, 2008). The basis of chiropractic medicine revolves around the principal that spinal joint misalignments can interfere with the nervous system and general function of the joints (Baker et al., 2005; Colloca & Keller, 2001; Ernst, 2003; Hanrahan, Van Lunen, Tamburello & Walker, 2005). Chiropractors use soft tissue massage, joint manipulations and mobilizations to help correct the theorized misalignments (Colloca et al., 2001; Ernst, 2003; Hanrahan et al., 2005). Chiropractic medicine has also been used as a preventive approach to musculoskeletal injury with the lumbar spine, gluteal region, and hamstrings among the most common areas receiving treatment (Crothers et al., 2008; Pollard & Hoskins, 2006).

Research related to chiropractic treatment has been mixed. Ernst (2003) reported through systematic review of the topic, that there is still no convincing evidence that chiropractic medicine has a beneficial effect on acute or chronic low back pain. This study also reports that chiropractic medicine can be seen as “dangerous” and may place patients at risk of further injury and osteoarthritis. The author also concludes that the risks associated with chiropractic medicine are not fully understood, and that chiropractors as a profession tend to portray a benefit that is unproven. Mirtz, Morgan, Wyatt and Greene, 2009, performed a systematic review of spinal manipulations for the correction of subluxations, which chiropractors claim cause a variety of disorders

throughout the body. This method to correct these subluxations is used by chiropractors, which declare that it corrects many disorders, including low back pain (Mitrz et al., 2009). This study used an epidemiological approach to causation, using Bradford-Hill's criteria to assess causation, and found a significant lack of evidence to support the treatment of subluxations (Mirtz et al., 2009). However, other studies have shown that spinal manipulations can decrease stiffness (Colloca & Keller, 2001), decrease pain (Colloca et al., 2001; Hanrahan et al., 2005), stimulate neuromuscular reflexes (Colloca et al., 2001), and promote motor activity and increase force production (Hanrahan et al., 2005). Some of the research also shows that spinal manipulations can cause an increase in performance (Shrier, Macdonald & Uchacz, 2006). One study reported that high velocity and low amplitude manipulations among healthy athletes trended towards a decrease in their 40-meter sprint time and increased their countermovement jump height (Shrier, Macdonald & Uchacz, 2006). More research, however, needs to be conducted in the area of performance and manipulations (Shrier, Macdonald & Uchacz, 2006).

The world of athletics is an extremely competitive environment, which drives the development and implementation of new techniques and new processes. Professionals involved in athletics look for effective practices that can speed an athlete's return to practice, increase performance, or gain an edge on their opponent (Colloca et al., 2001; Kazemi & Shearer, 2008; Nichols et al., 2006; Stump et al., 2002). Chiropractic medicine focuses on the treatment of musculoskeletal conditions, which attracts certified athletic trainers to utilize their services as another tool in injury rehabilitation (Colloca et al., 2001; Nichols et al., 2006; Stump et al., 2002). Based on the high prevalence of back pain

in athletes, the implementation of chiropractors into sports medicine is growing (Colloca et al, 2001; Kazemi et al., 2008; Nichols et al., 2006; Stump et al., 2002).

Nichols and Harrigan (2006) surveyed athletes at the University of Hawaii at Manoa, an NCAA Division I University, and determined that 56% of these athletes used a variety of forms of complementary and alternative medicine (CAM). Specifically, 29% of the student-athlete population utilized the services of chiropractors, which was second to only massage (38%) as alternative medicine used. Kazemi and Shearer (2008) reported that only 25% of taekwondo athletes surveyed at a national tournament have never seen a chiropractor and 12% of the athletes visit chiropractors often. This study also states that up to 15% of the athletes on the Canadian National Taekwondo team visit a chiropractor after suffering any injury. Stump and Redwood (2002) reported that chiropractor use in the National Football League (NFL) is common, with 77% of NFL certified athletic trainers (ATC) referring athletes to chiropractors. This study also reported that 33% of NFL teams employ a chiropractor as an official capacity as part of their staff. It is also reported that 100% of their athletes seek chiropractic care if it is referred or not.

These studies suggest that the prevalence of chiropractors in athletics is fairly high. Most of the aforementioned studies conclude that there is a lack of information surrounding the usage of chiropractors in the sports setting (Colloca et al., 2001; Kazemi et al., 2008; Nichols et al., 2006; Stump et al., 2002). There is little knowledge of the use of sport chiropractors at the collegiate level. Nichols and Harrigan (2006) surveyed one University outside of the continental United States and were not able to determine chiropractic usage by specific sport or by year in college.

Medical professional's knowledge of chiropractic medicine.

Although the prevalence of its use is high, medical professionals may not be fully educated about chiropractic medicine in order to understand its effects (Ernst, 2003; Johnson et al., 2004; Pollard et al., 2006; Stump et al., 2002). There are a few studies that were aimed to assess medical professionals knowledge of chiropractic care, as well as other alternative forms of medicine, with mixed results (Ernst, 2003; J. Johnson, 2004; P. Johnson, et al. 2008; Stump et al., 2002). One study looked at a survey of health educators, which revealed that most are familiar with complementary and alternative medicine, including chiropractic medicine, and are knowledgeable about their safety and effectiveness (Johnson, Lewis-Priestly & Johnson, 2008). This same study, however, determined that participants receiving the treatment were less knowledgeable about the process and benefits, and that health educators were more knowledgeable about these treatments than some medical aids actually performing the treatment (Johnson et al., 2008).

Pollard and Hoskins (2006) documented that sports chiropractors could be beneficial in both the prevention and treatment of athletic injuries, citing there is a difference between manipulation/mobilization and massage/stretching. Ernst (2003), in a systematic review of the topic, found there is no convincing evidence that chiropractic medicine has a beneficial effect on acute or chronic low back pain. The benefit of this treatment is therefore uncertain and thus needs more research.

Other health care professions seem to be skeptical of chiropractic medicine, however still employ chiropractic services (Ernst, 2003; Johnson, 2004; Stump et al.,

2002). Johnson (2004) states that certified athletic trainers seem to be skeptical of chiropractors, but also feels that the collaborative effort of the two professions would optimize benefits for injured patients. Of ATCs in the NFL, 45% see chiropractors as adequately trained and 36% agree that chiropractors need post doctorate training in sports medicine to be involved with athletes (Stump & Redwood, 2002). This, however, contradicts the ATCs actual plan of treatment. The same survey reported that 77% of the NFL's ATCs have referred their players to a chiropractor and 31% of the teams have a chiropractor on staff (Stump & Redwood, 2002). It is clear that other medical professionals need to have a better knowledge of chiropractic medicine to better understand chiropractors role in the treatment of their athlete's injury.

Use of chiropractors at the collegiate level.

Chiropractic medicine continues to be a profession that raises many questions among other health care professionals. It seems to be a highly sought after treatment by both the general public and athletes, amateur and professional. Stump and Redwood (2002); Kazemi and Shearer (2008) and Nichols and Harrigan (2006) all report high prevalence rates of chiropractic use among athletes, however there remains little knowledge about the specific prevalence among collegiate athletes. One study attempted to assess chiropractic use among collegiate athletes and reported a prevalence of 29%, however this assessed all complementary and alternative medicines and did not single out chiropractic medicine (Nichols & Harrigan, 2006). This study was also done with only one Division I University (University of Hawai'i at Manoa) and included in the results cultural medicines from the Hawaiian Islands (Nichols & Harrigan, 2006). Another

limitation of the study was that the athletes themselves were surveyed and the health care providers were not surveyed (Nichols & Harrigan, 2006).

Methods

A cross-sectional online survey questionnaire was developed to determine demographic information of collegiate certified athletic trainers, their methods of treating low back pain and prevalence of chiropractic use among collegiate athletes. The survey was developed by a combination of utilizing questions validated in a previous study (Stump and Redwood, 2002) and custom questions designed by the primary investigator. The questions by Stump and Redwood were previously used to investigate athletic trainers in the National Football League. The conclusions of Stump and Redwood, 2002, cannot be inferred at the collegiate level, therefore it was felt they would be useful tools to answer similar questions for a different, yet similar, population. The custom questions developed for the survey were completed with the assistance of Dr. Stephen D. Ross, a faculty member at the University of Minnesota within the Kinesiology department who has experience in survey design. Certified athletic trainers employed by the University of Minnesota were also consulted with the design of these questions. The survey can be found in Appendix A.

An online survey was utilized for the convenience of both the subjects and the researchers. A survey is a well-established method in gathering information about opinions and trends used in certain fields (Creswell, 2009). The objective of this study was to gather opinions and trends about low back pain treatment and chiropractic use

among certified athletic trainers, therefore the utilization of a survey is appropriate. The use of an online survey, resulted in a quick turn around in responses, survey multiple people at the same time and allow for the subjects to complete the survey at their own convenience in whatever environment they desire. The online website www.SurveyMonkey.com was used to conduct the online surveys. SurveyMonkey is a commonly used and recommended website that allows researchers to easily design a survey, collect responses and analyze results as the responses come in (Creswell, 2009). It is an inexpensive method where data can be collected accurately and efficiently.

Survey (See Appendix A)

Each question in the survey was designed to answer specific questions raised by the investigator. Questions 1 through 6 were meant to gain demographic information on the certified athletic trainers being surveyed, including years certified, highest level of education and sport assignment. Questions 7, 8 and 9 were used to determine the ATC's opinion on low back pain as it effects athletes. Questions 7 and 8 utilized a five-level Likert scale because of its widely accepted use in questionnaires, and as suggested by Dr. Stephen Ross. Question 9 was left open-ended as to not "handcuff" the subjects into answering in any particular way or set range of values.

Utilizing SurveyMonkey's format of questions, Question 10 was entered into the format of a "Matrix of drop-down menu." This made for both ease of the subjects and investigator. This question looked to answer if there were a preferred method, and order, of treatments utilized by ATCs. The subjects were able to list in order their preferred treatment. Question 11 was similar to question 10, however the subjects were only

allowed one response. This question was designed to force the subjects into picking simply one treatment, to determine not which treatment they preferred, but if the treatments could be separated, which they felt contributed the most to the success of low back pain rehabilitation.

Question 12 and 13 were developed to address ATC's use of Physical Therapists (PT) in the treatment of low back pain. Question 12 looked to identify the percentage of ATCs that refer athletes to PTs, and question 13 asked those that do refer athletes to PTs to describe their reasoning to do so. This question was left open ended to allow respondents to answer however they needed. Questions 14 and 15 were also of similar nature, using the same answer scale. These questions looked to determine how often ATCs and their physicians perform imaging on their athlete's with low back pain. The scale used was developed to incorporate possible outcomes and decisions a sports medicine team would have to make. Questions 16 and 17 were open-ended questions asking the ATC to estimate, using their own experience, the average amount of time loss for an athlete with low back pain. These questions incorporated both practice time and competition time lost. The primary investigator developed question 18 to see if athletic trainers were utilizing peer-reviewed research in their approach to low back rehabilitation and treatment. Looking into this issue further, the subjects who answered, "Yes" were asked in question 19 to list the journals they refer to. This would give the investigator an idea of common journals referenced and also ensure that the journals being referred were peer-reviewed.

The last set of questions sought to determine ATC's perception and utilization of chiropractic medicine with their athletes. Question 20 was asked to determine if ATCs on staff were performing mobilization techniques themselves. Question 21 was made to see if the ATCs themselves are being treated by chiropractors, giving a possible inference on their perception of the treatment. Questions 22 through 25 were asked to determine the level of cooperation ATCs are having with chiropractors, with question 25 asking that if there were no cooperation and the services were thus provided, would they utilize them? Earlier in this review, it was stated that there is an increased demand for chiropractic services by athletes, therefore question 26 was designed to view this issue from the perspective of a medical staff. Another issue raised earlier was the effects of chiropractic medicine on performance; therefore questions 27 and 28 were developed to investigate if chiropractic medicine is being utilized for this purpose.

Question 29 was designed, as described below, as another method to ensure informed consent and responsible research conduct. For further insight by the subjects, they were asked in question 30 to provide any comments they felt would aid in the review of this research.

Participants

Participants in this study were certified athletic trainers working in the collegiate setting. ATCs were chosen at random by single stage sampling using the National Athletic Trainer's Association (NATA) website (www.nata.org). Using an online program, as suggested by Creswell, 2009, a power analysis to determine sample size was calculated. G*Power is a free, online, power analysis program which was utilized for this

calculation. The data calculation suggested a sample size of 150 individuals. Through the member's section of the NATA website, email accounts of ATCs around the country were accessed and sorted by clinical work setting. The list was sorted to display ATCs working in collegiate settings. There were a total of 250 pages with 20 individuals listed on each page. The first 2 ATC's listed on each page were added to a collective e-mailing list of 500. If one of the two ATC's listed had anything in their profile about being in academia as opposed to working with athletes, the next appropriate name on the list was chosen. This was done to limit the number of surveys sent to individuals who did not directly work with athletes. Turocy, 2002, reported a typical survey response rate of about 60% among this specific population with the adherence of several suggestions including time of year sent and follow up reminders. For the purpose of this research, the response rate was underestimated to ensure an adequate number of surveys returned. Surveys were sent out to 500 individuals, leaving this research to obtain a response rate of 30% to gain the appropriate sample size. The initial email (see Appendix B) was sent on Monday, March 22, 2010 at 10:00 AM. A second, reminder email (see Appendix C) was sent three weeks later on Monday, April 12, 2010 to help maximize response rate. The sample of ATC's selected was utilized to gather a better understanding of this population as a whole.

Confidentiality and Informed Consent

The Institutional Review Board (IRB) at the University of Minnesota accepted this research as exempt category two, which does not require a signature of informed consent. Therefore, each qualifying participant was sent an introductory email discussing

the purpose of the study and plainly communicated that the survey was voluntary (see Appendix B). It was also made clear that there were no penalties for non-participation in the. The cover letter also communicated that by clicking on the link to the survey, they were providing implied consent. Another method taken by the primary investigator to ensure consent was by adding a final question on the survey. This last questions asked the participant to check an answer box that stated they provided consent to use their answers in the case of publication. This questionnaire was a one-time event. There was no additional contact with the subjects and they did not respond to the initial email. The online survey contained no identifying marks and was set up so it did not collect any identifiable information from the person taking the survey, therefore was purely anonymous. The online survey had a secure account username and password that was known only by the primary investigator, ensuring confidentiality of all results. The completed surveys were stored in an online database and will be deleted upon completion of this study for confidentiality.

Statistical Analysis

For the statistical analysis of this survey, the Office of Research Consultation and Services (ORCS) were utilized. The primary investigator was paired with Tony Albano, a Ph.D. candidate in the department of Educational Psychology who has experience in survey design, consultation and analysis. After consultation, the main form of statistical analysis was descriptive statistics. The primary investigator will report percentages of answer selections as well as percentages of dichotomous yes/no questions.

SurveyMonkey provided these analyses for its subscribed members and reported them in summary statistics, which can be downloaded and viewed in programs such as Microsoft Xcel and SPSS. For the purpose of this study, each program was used to ensure validation of responses.

Results

A total of 500 survey cover letters were mailed to certified athletic trainers around the country. The online survey had 151 responses as of April 17, 2010 and was therefore closed by the primary investigator. Although this only gave a response rate of 30.2%, the suggested sample size was met. A question-by-question breakdown of results can be found in Appendix D.

All of the 151 subjects surveyed were certified athletic trainers and were certified for an average of 10.1 years with a range from 1 year to 35 years. Seventy-four percent of subjects were certified through the current Commission on Accreditation of Athletic Training Education (CAATE), with the remaining 26.0% achieving certification through the old internship route. One hundred-sixteen, or 76.8% of those surveyed obtained their master's degree, 32 (21.2%) completed their bachelor's degree, and 3 (2.0%) had received their doctorate.

The distribution of sport coverage varied, with the most reported sport assignment being football, with 50 subjects (33.1%) claiming it as a primary assignment. Table 1 represents a breakdown of reported sport assignments, sorted by primary sport

assignment, or the selection "1" from the survey. Tennis was the most reported secondary assignment with 20 subjects (13.2%) reporting it as their secondary coverage.

Table 1: Distribution of ATC's sport assignments, in order of primary assignment.

Question 15: Of the following sports assignments please specify the sport teams that consume most of your time. (Mark a 1 for the team you spend the most time with, 2 for secondary assignment, etc.)

Answer Options	1	2	3	4	5	6	7	8	9	10	11	Response Count
Football	50	9	3	1	1	0	0	1	0	0	0	76
Basketball	37	8	2	2	1	1	2	1	0	1	1	61
Other	28	16	7	2	2	1	0	0	2	0	0	58
Soccer	26	10	3	1	3	2	3	0	0	0	0	53
Baseball	11	5	2	3	3	4	2	1	0	1	0	40
Track & Field/Cross Country	11	14	9	5	0	0	2	0	0	0	0	49
Softball	10	6	4	1	2	2	4	0	0	0	0	36
Wrestling	6	2	0	1	1	1	0	0	0	0	0	27
Swimming/Diving	5	8	9	2	3	2	0	4	0	0	0	42
Hockey	5	0	0	0	1	0	0	2	0	0	0	24
Tennis	4	20	8	4	0	1	1	2	2	1	0	51
Gymnastics	1	2	0	1	0	0	0	0	1	0	0	24

When asked about low back pain, the majority, 98 (64.9%) "Agreed" that low back pain is common in athletics, with an additional 32.5% "Strongly Agreeing." The majority of subjects (47.2%), however, "Disagreed" that low back pain was a common career ending injury. The majority of subjects also felt the percentage of low back pain among athletes was between 5-10%.

Tables 2 and 3 outline subject's preferred treatment of low back pain. The subjects selected their highest preferred treatment as "1," next preferred as "2" and so on. The subjects did not have to rank the other treatments and could simply select "N/A" or leave it blank. Core strengthening/stabilization was the highest ranked treatment

receiving 70 number "1" responses. Also of note, CAM treatment was seen as the treatment most selected as "N/A."

Table 2: Distribution of preferred treatment of low back pain by certified athletic trainers.

Question 10: What is your preferred method of treatment for mechanical low back pain? (Please list in numerical order, with the highest preferred treatment as 1).										
Answer Options	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**N/A**	**Response Count**
Core Strengthening/Stabilization	70	32	20	12	1	1	1	2	0	139
Modalities (TENS, ultrasound, cryotherapy, etc.)	36	10	35	25	7	4	1	1	0	119
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	19	27	20	21	19	11	6	0	5	128
Stretching	19	50	24	20	4	1	3	1	0	122
Oral Anti-inflammatory medications	5	15	21	20	29	9	5	0	0	104
Manipulations (Chiropractor)	1	10	10	11	26	29	13	6	2	108
Complementary and alternative medicine (acupuncture, etc.)	1	0	2	2	5	10	22	28	20	90
Corticosteroid injections	0	1	2	3	6	25	25	25	6	93

Table 3: Question 10: Ranking of Preferred Treatments.

Number 1 Preferred Treatment	
Core strengthening/Stabilization	70
Modalities (TENS, ultrasound, cryotherapy, etc.)	36
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	19
Stretching	19
Oral Anti-inflammatory medications	5
Manipulations (Chiropractor)	1
Complementary and alternative medicine (acupuncture, etc.)	1
Corticosteroid injections	0

Number 2 Preferred Treatment	
Stretching	50
Core strengthening/Stabilization	32
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	27
Oral Anti-inflammatory medications	15
Modalities (TENS, ultrasound, cryotherapy, etc.)	10
Manipulations (Chiropractor)	10
Corticosteroid injections	1
Complementary and alternative medicine (acupuncture, etc.)	0

Number 3 Preferred Treatment	
Modalities (TENS, ultrasound, cryotherapy, etc.)	35
Stretching	24
Oral Anti-inflammatory medications	21
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	20
Core strengthening/Stabilization	20
Manipulations (Chiropractor)	10
Corticosteroid injections	3
Complementary and alternative medicine (acupuncture, etc.)	2

Number 4 Preferred Treatment	
Modalities (TENS, ultrasound, cryotherapy, etc.)	25
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	21
Stretching	20
Oral Anti-inflammatory medications	20
Core strengthening/Stabilization	12
Manipulations (Chiropractor)	11
Corticosteroid injections	3
Complementary and alternative medicine (acupuncture, etc.)	2

Number 5 Preferred Treatment	
Oral Anti-inflammatory medications	29
Manipulations (Chiropractor)	26
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	19
Modalities (TENS, ultrasound, cryotherapy, etc.)	7
Corticosteroid injections	6
Complementary and alternative medicine (acupuncture, etc.)	5
Stretching	4
Core strengthening/Stabilization	1

Number 6 Preferred Treatment	
Manipulations (Chiropractor)	29
Corticosteroid injections	25
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	11
Complementary and alternative medicine (acupuncture, etc.)	10
Oral Anti-inflammatory medications	9
Modalities (TENS, ultrasound, cryotherapy, etc.)	4
Core strengthening/Stabilization	1
Stretching	1

Number 7 Preferred Treatment	
Corticosteroid injections	25
Complementary and alternative medicine (acupuncture, etc.)	22
Manipulations (Chiropractor)	13
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	6
Oral Anti-inflammatory medications	5
Stretching	3
Core strengthening/Stabilization	1
Modalities (TENS, ultrasound, cryotherapy, etc.)	1

Number 8 Preferred Treatment	
Complementary and alternative medicine (acupuncture, etc.)	28
Corticosteroid injections	25
Manipulations (Chiropractor)	6
Core strengthening/Stabilization	2
Modalities (TENS, ultrasound, cryotherapy, etc.)	1
Stretching	1
Oral Anti-inflammatory medications	0
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	0

Treatment Thought as Non-Applicable	
Complementary and alternative medicine (acupuncture, etc.)	20
Corticosteroid injections	6
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	5
Manipulations (Chiropractor)	2
Oral Anti-inflammatory medications	0
Core strengthening/Stabilization	0
Stretching	0
Modalities (TENS, ultrasound, cryotherapy, etc.)	0

Core strengthening/stabilization was also seen as the treatment that subjects felt contributed most to the success of the athlete's rehabilitation. The subjects were forced to select only one response to which treatment they felt contributed most to the success of rehabilitation and the results are outlined in Table 4.

Table 4: Distribution of ATC's treatment deemed to contribute the most to the success of rehabilitation.

Question 11: Which treatment of low back pain do you feel contributes the most to the success of the athlete's rehabilitation?		
Answer Options	**Response Percent**	**Response Count**
Core Strengthening/Stabilization	66.2%	100
Manual Therapy (ART, Muscle Energy, GRASTON, etc.)	13.9%	21
Stretching	8.6%	13
Modalities (TENS, ultrasound, cryotherapy, etc.)	4.6%	7
Rest	4.6%	7
Manipulations (Chiropractor)	1.3%	2
Oral Anti-inflammatory medications	0.7%	1
Complementary and alternative medicine (acupuncture, etc.)	0.0%	0
Corticosteroid injections	0.0%	0

Only 66.2% of subjects reported that they read peer-review literature summarizing low back pain, with the Journal of Athletic Training being the most read journal. About 65% of the ATCs surveyed reported working professionally with a chiropractor, with just less than half having one employed by their university. Thirty-six percent of those who did not have a chiropractor on staff stated they would not utilize their services even if one were hired. One hundred seventeen (77.5%) of subjects reported that they had referred athletes with low back pain to a chiropractor.

Discussion

The certified athletic trainers who participated in this study seem to represent a satisfactory population sample of collegiate certified athletic trainers as a whole. All 151 were certified for an average of 10.1 years, with 74% of the sample having gone through an athletic training CAATE accredited program. The majority of the subjects have completed at least a master's degree with 78.8% achieving a degree beyond their bachelor's degree. Although football was reported most for covered sports, each sport was represented in some capacity. The majority, 78.8%, of surveyed athletic trainers covered an NCAA Division I sport; however each NCAA division was represented as well as the National Junior College Athletic Association (NJCAA).

As expected, almost all of the subjects, 97.4%, either agreed or strongly agreed that low back pain is common in college athletics, with no one strongly disagreeing with the statement. However, responses were not one sided when asked if low back pain caused an athlete's career to end. A little over 50% of the subject disagreed in some capacity with this statement, and 28.5% straddled the fence by neither agreeing nor disagreeing. The overall estimated percentage of low back pain in athletics was a bit scattered, although 70.2% of subjects independently reported a value between 5-15%.

When assessing preferred treatment of low back pain, ATC's could select between manual therapy, manipulation, complimentary and alternative medicine (CAM), modalities, corticosteroid injections, oral anti-inflammatory medication, core strengthening/stabilization and stretching. The subject could also select N/A if they felt the treatment was non applicable. Core strengthening/stabilization was the most preferred

treatment with 46.3% reporting it as their number 1 treatment, and 139 selected it at some level in their preferred treatments, which was the most among any other treatment. The second most reported treatment overall was manual therapy, 123, followed by stretching at 122. Stretching received the most responses as the second most preferred treatment by receiving 50 selections. Modalities, surprisingly, followed only core strengthening/stabilization as the number 1 preferred treatment, with 23.8% of respondents reporting them as their preferred treatment. Complementary and alternative medicines, followed by corticosteroid injections, were the least preferred across the board. Interestingly, chiropractic medicine/manipulations did not receive much support as a primary treatment, but was among the highest reported for the 5th, 6th and 7th preferred treatments. When forced to select only one treatment, 80.1% selected either core strengthening/stabilization (66.2%) or manual therapy (13.9%).

The ATC's were split 49% "no" and 51% "yes" when asked if they had ever referred an athlete with low back pain to a Physical Therapist (PT). The subjects that answered, "Yes," reported many different reasons for referral and commented on the cooperation of many different health care professionals for the overall success of injury treatment. In the comments after the survey, some of the subjects brought up the fact that they were dual credentialed as a PT/ATC. The subjects in this survey, unfortunately, were not asked about dual credentials and therefore this variable could not be controlled for in this study.

The questions regarding imaging were somewhat varied, specifically for x-ray imaging. The results were almost even for time intervals for performing x-ray imaging,

with only 4 responses total for “immediately” or “never.” Results for receiving an MRI were a bit more skewed; with 57% of the subjects reporting only getting an MRI when neurological symptoms were present. These values can vary greatly by athlete, types of symptoms, time of season, etc. Therefore, these questions may have been better suited as an open-ended format.

Total time lost with low back was also of interest to the investigators. Although many individuals did not report a value and stated that these times vary, it was of interest to get a general idea from other ATC’s experiences. Most individuals who did provide a number, estimated from 4 to 10 days lost. When the participants who did not provide a number were excluded, nearly 60% of the subjects estimated a value within this range. Similarly to practice time loss, when those who did not provide a number response were excluded, 67.2% of the subjects reported 1 to 2 competitions lost due to low back pain.

When asked if they read peer-reviewed literature on the subject of low back pain, 66.1% of ATCs surveyed responded, “yes.” This was thought by the primary investigator to be low. Most of the literature reports that low back pain is a topic that needs more attention and is felt that most athletic trainers need to keep up with the current literature.

The last set of questions looked to examine chiropractic medicine and its use and perception by certified athletic trainers. The results were nearly split when asked if they, or other athletic trainer on staff, performed joint mobilization for low back pain. There were 49.7% that responded, “Yes” and 50.3% that responded, “No.”

The majority, 61.6%, reported having been personally treated by a chiropractor, with a similar percentage, 64.9%, having worked professionally with a chiropractor at

some point in their career. Only 47.7% of respondents claimed to have a chiropractor as an official part of it's staff, meaning some ATCs are referring athletes to chiropractors outside of their medical team. Those who did not report having a chiropractor on staff were asked if they would utilize their services if one was provided, and 63.3% said they would. Seventy-seven percent of the subjects had reported referring an athlete with low back pain to a chiropractor for treatment. This coincides with previous research by Stump and Redwood (2002) who reported that 77% of NFL athletic trainers refer their athletes to chiropractors.

There is an increased demand for chiropractic services by athletes. Stump and Redwood (2002); Kazemi and Shearer (2008) and Nichols and Harrigan (2006) all report high prevalence rates of chiropractic use by athletes. Although slightly over 77% of surveyed ATC's admitted referring athletes to chiropractors, they only reported "some" athletes seeking treatment outside of referral. This could either result from a high number of referrals from the medical staff or the ATCs being unaware of the athlete's treatment.

Chiropractic use and its effect on performance are also not clearly understood. To investigate if chiropractic medicine is being utilized for increased performance, the ATCs were asked if their athletes utilize chiropractors for pre-game manipulations. Only 14.6% reported that their athletes received pre-game manipulations, those of which reported reasons such as the fact that it was "the player's preference," athletes said it "loosened them up," "made them feel better," or "athlete's said it helped performance."

The last question on the survey asked participants to provide any feedback they felt necessary to aid in the advancement of this study, with 18 subjects providing

constructive comments. Many of the individuals stressed that low back pain is complex and protocols must be developed from current symptoms and individual athletes. Some of the comments include that “there is no clear cut path to low back pain rehabilitation.” “We do not have a standard protocol for ordering x-rays and MRIs, each case is treated separately with symptoms determining time line for follow up care.”

Most of the comments also included their “thoughts” on chiropractic medicine. Some individuals saw chiropractic medicine in a positive light. They reported, “chiropractors can be beneficial in a limited capacity with proper strengthening protocols.” “I do not have an issue with chiropractic care, we just have people on staff who provide excellent care so there is no need for one.” “I feel that if possible, treatments/modalities that chiropractors use should be incorporated into AT clinical education, such as ART and manipulation, I feel they work better than our traditional therapies/modalities such as stim and ultrasound.” “In regards to whether I would utilize a chiropractor if one was on staff my answer was yes, but only if they were controlled by myself of when and why they did their manipulations. They would perform their treatments in conjunction with my athletic training staff and there would be guidelines.” Others reported chiropractic medicine more negatively stating “Our orthopedist and neurologist do not advocate referral to those offering chiropractic services”; “We have DO doctors to performs manipulations because they are better trained”; “I have a very low opinion of Chiropractic "medicine." It is based on psudoscience and superstition. The research that shows chiropractic care to be of any benefit is far from chiropractic

"theory." These chiropractor are using standard care; manual therapy, stretching, strengthening, not adjustments for "subluxations", etc.”

It is clear that both low back pain treatment and chiropractic care are highly complex and not yet fully understood. More research needs to continue in these areas to assist clinicians in their role of health care providers.

Limitations

The limitations of this survey coincide with the limitations of most surveys. First, the questions asked might not have been perceived by the respondent exactly how the researcher intended them to. This, however, was controlled as efficiently as possible with the wording of questions, as well as advice sought by professionals in the fields of sports medicine and survey research. Other limitations included the selection procedures of subjects. Again, as in a typical survey, if an ATC was not listed on the NATA website, they did not have a fair chance to be represented.

Another limitation could have been the inclusion of Division I, II, and III schools due to resource differences. Stratifying the results between the three levels of institutions may reveal different processes of treatment in future research, however was not done in this study due to the gross inequality of subjects in each group.

Specifically, a few questions could have been changed or excluded. When asked about estimating percentage of low back pain or time loss due to injury, the survey could have asked the subjects to report from actual records, although the response rate may have decreased with this demand. Also, the imaging questions could have been made

open-ended response questions so that the subjects did not have to answer in any specific way. One other issue was that this survey did not incorporate a question asking if there were dual credentialed individuals in PT/ATC.

At the end of the survey, the participants were asked to provide any feedback they felt necessary to aid in the advancement of this study, with 18 subjects providing constructive comments. Most of the comments included their "thoughts" on chiropractic medicine and low back pain treatment. However, there were a few that added comments about the structure of the survey and it is felt these comments need be reported in this section of the research. One participant stated, "Some questions were vague and should have gone into more detail." This subject failed to denote any specific questions, however this statement agrees with some of the above stated limitations on specific questions such as the ones involving imaging. Another comment said, "You failed to include treatment of low back pain with a device called the ATM2." This subject also reported a personal high success rate with this device and stated they would have marked it as their number one treatment preference. This device was not referenced in any of the literature used for the review for this study, however if there are clinicians using this treatment, it should be further investigated to validate its usefulness in the treatment of low back pain. Lastly, one subject mentioned that the survey did not incorporate a question including individuals who are dual credentialed in PT/AT, as stated above. Although this could have been another question incorporated into the survey, they survey itself was developed to investigate certified athletic trainers, and this question would not have made a major impact to the overall purpose of this study.

Practical Applications

The intention of this research was to provide an overall better understanding of low back pain and its treatment by certified athletic trainers. Low back pain is a complex injury, which makes it complicated to understand its treatment and rehabilitation. Based on responses from this survey, core strengthening/stabilization and manual therapies are among the most common used treatments for low back pain. More research needs to focus on these areas to provide proper feedback to clinicians performing these techniques.

It was also an objective to define a role of chiropractic medicine in the collegiate sports medicine team. The questions on this survey were developed to understand ATC's perception of chiropractic medicine as well as the rate at which their services are utilized. The outcomes showed a high rate of referrals and use by ATCs, however their current role is still not completely understood. The results of this survey will hopefully provide a push for sports medicine professionals to better understand chiropractic medicine and the services provided to their athletes. More research needs to be completed to indentify a place for chiropractors in the sports medicine field. Overall this research was aimed to spark new research ideas that can help sports medicine professionals in understanding low back pain treatment and chiropractic services.

References

Baker, R.J., & Patel, D. (2005). Lower back pain in the athlete: common conditions and treatment. *Primary Care: Clinics in Office Practice 32,* 201-229.

Battle, M.C., Cherkin, D.C., Dunn, R., Cloi, M.A., & Wheeler, K.J. (1994). Managing low back pain: Attitudes and treatment preferences of physical therapists. *Journal of Physical Therapy, 74(3),* 219-226.

Bono, C.M. (2004). Low-back pain in athletes. *Journal of Bone and Joint Surgery, 86-A(2),* 382-396.

Brooks, G., Dripchak, S., Vanbeveren, P., & Allaben, S. (2008). Is a prescriptive or an open referral related to physical therapy outcomes in patients with lumbar spine-related problems? *Journal of Orthopaedic & Sports Physical Therapy, 38*(3), 109-115.

Busanich, B.M., & Verscheure, S.D. (2006). Does McKenzie therapy improve outcomes for back pain? *Journal of Athletic Training, 41(1),* 117-119.

Cholewicki, J., Silfies, S.P., Shah, R.A., Greene, H.S., Reeves, P., Alvi, K., & Goldberg, B. (2005). Delayed trunk muscle reflex responses increase the risk of low back injuries. *Spine, 30(21),* 2614-2620.

Colloca, C. J., & Keller, T. S. (2001). Stiffness and neuromuscular reflex response of the human spine to posteroanterior manipulative thrusts in patients with low back pain. *Journal of Manipulative and Physiological Therapeutics, 24*(8), 489-500.

Colloca, C.J., Keller, T.S., Harrison, D.E., Moore, R.J., Guzenburg, R., Harrison, D.D. (2006). Spinal manipulation force and duration affect vertebral movement and

Crothers, A., Walker, B., & French, S.D. (2008). Spinal manipulative therapy versus Graston Technique in the treatment of non-specific thoracic spine pain: Design of a randomized controlled trial. *Journal of Chiropractic and Osteopathy, 16(12).*

Durall, C. J., Udermann, B. E., Johansen, D. R., Gibson, B., Reineke, D. M., & Reuteman, P. (2009). The effects of preseason trunk muscle training on low-back pain occurrence in women collegiate gymnasts. *Journal of Strength and Conditioning Research / National Strength & Conditioning Association, 23*(1), 86-92.

Ernst, E. (2003). Chiropractic spinal manipulation for back pain. *British Journal of Sports Medicine, 37,* 195-196.

Foley, B. S., & Buschbacher, R. M. (2006). Sacroiliac joint pain anatomy, biomechanics, diagnosis, and treatment. *American Journal of Physical Medicine & Rehabilitation, 85*(12), 997-1006.

Gerbino, P. G., & d'Hemecourt, P. A. (2002). Does football cause an increase in degenerative disease of the lumbar spine? *Current Sports Medicine Reports, 1*(1), 47-51.

Hagins, M., Adler, K., Cash, M., Daugherty, J., & Mitrani, G. (1999). Effects of practice on the ability to perform lumbar stabilization exercises. *Journal of Orthopaedic & Sports Physical Therapy, 29*(9), 546-555.

Hangai, M., Kaneoka, K., Hinotsu, S., Shimizu, K., Okubo, Y., Miyakawa, S., et al. (2009). Lumbar intervertebral disk degeneration in athletes. *American Journal of Sports Medicine, 37*(1), 149-155.

Hanrahan, S., Van Lunen, B. L., Tamburello, M., & Walker, M. L. (2005). The short-term effects of joint mobilizations on acute mechanical low back dysfunction in collegiate athletes. *Journal of Athletic Training, 40*(2), 88-93.

Harris-Hayes, M., Sahrmann, S. A., & Van Dillen, L. R. (2009). Relationship between the hip and low back pain in athletes who participate in rotation-related sports. *Journal of Sport Rehabilitation, 18*(1), 60-75.

Hayashi, F., Sakai, T., Sairyo, K., Katoh, S., & Yasui, N. (2009). Bertolotti's syndrome among sports players. *Japanese Journal of Clinical Sports Medicine, 17*(1), 71-75.

Hebert, J., Koppenhaver, S., Fritz, J., & Parent, E. (2008). Clinical prediction for success of interventions for managing low back pain. *Clinics in Sports Medicine, 27*(3), 463-479.

Hibbs, A. E., Thompson, K. G., French, D., Wrigley, A., & Spears, l. (2008). Optimizing performance by improving core stability and core strength. *Sports Medicine, 38*(12), 995-1008.

Hides, J., Stanton, W., Freke, M., Wilson, S., McMahon, S., & Richardson, C. (2007). MRI study of the size, symmetry and function of the trunk muscles among elite cricketers with and without low back pain. *British Journal of Sports Medicine, 42*(10), 509-513.

Hides, J., Stanton, W., Mcmahon, S., Sims, K., & Richardson, C. (2008). Effect of stabilization training on multifidus muscle cross-sectional area among young elite cricketers with low back pain. *Journal of Orthopaedic & Sports Physical Therapy, 38*(3), 101-108.

Iwamoto, J., Takeda, T., Sato, Y., & Wakano, K. (2006). Short-term outcome of conservative treatment in athletes with symptomatic disc herniation. *American Journal of Physical Medicine and Rehanbilitation, 85,* 667-674.

Iwamoto, J., Abe, H., Tsukimura, Y., & Wakano, K. (2005). Relationship between radiographic abnormalities of lumbar spine and incidence of low back pain in high school rugby players: A prospective study. *Scandinavian Journal of Medicine & Science in Sports, 15*(3), 163-168.

Iwamoto, J., Abe, H., Tsukimura, Y., & Wakano, K. (2004). Relationship between radiographic abnormalities of lumbar spine and incidence of low back pain in high school and college football players. *American Journal of Sports Medicine, 32,* 781-786.

Johnson, J. (2004). Chiropractic care and athletic training. *Athletic Therapy Today, 9(2),* 54-55.

Johnson, P., Lewis-Priestly, J., & Johnson, R.D., (2008). A survey of complementary and alternative medicine knowledge among health educators in the United States. *American Journal of Health Educators, 39(2),* 66-80.

Kazemi, M., & Shearer, H. (2008). Chiropractic utilization in taekwondo athletes. *Journal of Canadian Chiropractor Association, 52(2),* 96-102.

Kolber, M. J., & Zepeda, J. (2004). Addressing hamstring flexibility in athletes with lower back pain: A discussion of commonly prescribed stretching exercises. *Strength & Conditioning Journal, 26*(1), 18-23.

Kolber, M. J., & Beekhuizen, K. (2007). Lumbar stabilization: An evidence-based approach for the athlete with low back pain. *Strength & Conditioning Journal (Allen Press), 29*(2), 26-38.

Kolber, M. J., & Fiebert, I. M. (2005). Addressing flexibility of the rectus femoris in the athlete with low back pain. *Strength & Conditioning Journal (Allen Press), 27*(5), 66-73.

Lamoth, C. J., Meijer, O. G., Daffertshofer, A., Wuisman, P. I., & Beek, P. J. (2006). Effects of chronic low back pain on trunk coordination and back muscle activity during walking: Changes in motor control. *European Spine Journal : Official*

Publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society, 15(1), 23-40.

Miller, E.R., Schenk, R.J., Karnes, J.L, & Rousselle, J.G. (2005). A comparison of the McKenzie approach to a specific spine stabilization program for chronic low back pain. *Journal of Manual and Manipulative Therapy, 13(2),* 103-112.

Mirtz, T.A., Morgan, L., Wyatt, L.H. & Greene, L. (2009). An epidemiological examination of the subluxation construct using Hill's criteria of causation. *Journal of Chiropractic and Osteopathy, 17(13), 13-17.*

Nadler, S.F.,, Moley, P., Malanga, G.A., Rubbani, M., Prybicien, M., & Feinberg, J.H. (2002). Functional deficits in athletes with a history of low back pain. *Journal of Physical Medicine and Rehabilitation, 83(12),* 1753-1758.

Nelson-Wong, E., Flynn, T. W., & Callaghan, J. P. (2009). Development of active hip abduction as a screening test for identifying occupational low back pain. *The Journal of Orthopaedic and Sports Physical Therapy, 39*(9), 649-657.

Nichols, A.W., & Harrigan, R. (2006). Complementary and alternative medicine usage by intercollegiate athletes. *Clinical Journal of Sports Medicine, 16(3).* 232-237.

Ong, A., Anderson, J., & Roche, J. (2003). A pilot study of the prevalence of lumbar disc degeneration in elite athletes with lower back pain at the Sydney 2000 Olympic Games. *British Journal of Sports Medicine, 37,* 263-266.

Peterson, C., & Hodler, J. (2009). Evidence-based radiology (part 1): Is there sufficient research to support the use of therapeutic injections for the spine and sacroiliac joints? *Skeletal Radiology,*

Pollard, H., & Hoskins, W. (2006). Scope of sports chiropractic required for the successful prevention of hamstring and other lower limb injury. *Journal of Science and Medicine in Sport, Supplement, 10.*

Reeves, N. P., Cholewicki, J., & Silfies, S. P. (2006). Muscle activation imbalance and low-back injury in varsity athletes. *Journal of Electromyography & Kinesiology, 16*(3), 264-272.

Ross, M. D. (2007). Preventing low back pain with athlete education and the prone press-up exercise. *Strength & Conditioning Journal (Allen Press), 29*(6), 78-80.

Semon, R. L., & Spengler, D. (1981). Significance of lumbar spondylolysis in college football players. *Spine, 6*(2), 172-174.

Shrier, I., Macdonald, D., & Uchacz, G. (2006). A pilot study on the effects of pre-event manipulation on jump height and running velocity. *British Journal of Sports Medicine, 40.* 947-949.

Stewart, S., Stanton, W. R., Wilson, S. J., & Hides, J. A. (2009). Consistency in size and asymmetry of the psoas major muscle among elite footballers. *British Journal of Sports Medicine,*

Stump, J. L., & Redwood, D. (2002). The use and role of sport chiropractors in the national football league: A short report. *Journal of Manipulative and Physiological Therapeutics, 25*(3), E2.

Sullivan, M.S., Kues, J.M., & Mayhew, T.P. (1996). Treatment categories for lower back pain: a methodological approach. *Journal of Orthopaedic and Sports Physical Therapy, 24(6).* 359-364.

Swann, E. & Granner, S. (2002). Use of manual-therapy techniques in pain management. *Athletic Therapy Today. 7(4).* 14-17

Thein-Nissenbaum, J., & Boissonnault, W. G. (2005). Differential diagnosis of spondylolysis in a patient with chronic low back pain. *The Journal of Orthopaedic and Sports Physical Therapy, 35*(5), 319-326.

Turocy, P.S. (2002). Survey research in athletic training: the scientific method of development and implementation. *Journal of Athletic Training, 37(4), S-174-S179.*

Werneke, M. W., Hart, D. L., Resnik, L., Stratford, P. W., & Reyes, A. (2008). Centralization: Prevalence and effect on treatment outcomes using a standardized operational definition and measurement method. *Journal of Orthopaedic & Sports Physical Therapy, 38*(3), 116-125.

Wilson, E., Payton, O., Donegan-Shoal, L., & Dec, K. (2008). Muscle energy technique in patients with acute low back pain: A pilot clinical trial. *Journal of Orthopedic & Sports Physical Therapy 33(9).* 502-512.

Appendix A – Survey

1. Are you a certified athletic trainer? (If no, thank you for your time but please do not complete this survey)
    a. Yes
    b. No

2. How many years have you been certified?
    -Subjects were provided an open blank in the online version, categories were created based on responses.

3. Did you receive your Athletic Training degree from a CAATE accredited program?
    a. Yes
    b. No(If "NO" please specify how was your certification achieved?)
    -Subjects were provided an open blank in the online version.

4. What is the highest degree of education you have completed?
    a. Bachelors
    b. Masters
    c. Doctorate

5. Of the following sports assignments, please specify the sport teams that consume most of your time. (Mark a 1 for the team you spend the most time with, 2 for secondary assignment, etc.)
    a. _____ Football
    b. _____ Basketball
    c. _____ Baseball
    d. _____ Softball
    e. _____ Soccer
    f. _____ Swimming/Diving
    g. _____ Wrestling
    h. _____ Track & Field/Cross Country
    i. _____ Gymnastics
    j. _____ Tennis
    k. _____ Hockey
    l. _____ Other: Please specify _____
    -Subjects were provided a drop down menu for each response selection in the online version. Each drop down menu had the selections in numbers from 1-5 and an N/A response.

6. At what level does your current institution or specific sport compete in?
    a. Division I
    b. Division II
    c. Division III
    d. Other

7. How well do you agree with the following statement: "Low back pain is common in collegiate athletics."
    a. Strongly agree
    b. Agree
    c. Neither agree nor disagree
    d. Disagree
    e. Strongly disagree

8. How well do you agree with the following statement: "Low back pain is a common injury causing an athlete's career to end."
    a. Strongly agree
    b. Agree
    c. Neither agree nor disagree
    d. Disagree
    e. Strongly disagree

9. What do you estimate is the percentage of low back pain compared to all athletic injuries as a whole?
    -Subjects were provided an open blank in the online version, categories were created based on responses.

10. What is your preferred method of treatment for mechanical low back pain? (Please list in numerical order, with the highest preferred treatment as 1)
    a. Manual therapy (ART, Muscle energy, GRASTON, etc.)
    b. Manipulations (Chiropractor)
    c. Complementary and alternative medicine (acupuncture, energy healing, etc.)
    d. Modalities (US, TENS, Ice, etc.)
    e. Corticosteroid injections
    f. Anti-inflammatory medications
    g. Core Strengthening/Stabilization
    h. Stretching
    -Subjects were provided a drop down menu for each response selection in the online version. Each drop down menu had the selections in numbers from 1-8 and an N/A response.

11. Which treatment of low back pain do you feel contributes the most to the success of the athlete's rehabilitation?
    a. Manual therapy (ART, Muscle energy, GRASTON, etc.)
    b. Manipulations (Chiropractor)
    c. Complementary and alternative medicine (acupuncture, energy healing, etc.)
    d. Modalities (US, TENS, Ice, etc.)
    e. Corticosteroid injections
    f. Core Strengthening/Stabilization
    g. Rest

    -Subjects were only allowed 1 response.

12. Have you ever referred an athlete suffering from low back pain to a Physical Therapist (PT) for treatment or evaluation?
    a. Yes
    b. No

13. If you answered "YES" to the previous question, briefly describe the reasons for referral and procedures performed.

14. How often do you perform X-ray imaging on athletes with low back pain?
    a. Immediately
    b. If pain/disability persists > 1 week
    c. If pain/disability persists > 2 weeks
    d. If pain/disability persists > 1 month
    e. Only if neurologic symptoms are present
    f. Never

15. How often do you perform Magnetic Resonance Imaging (MRI) on athletes with low back pain?
    a. Immediately
    b. If pain/disability persists > 1 week
    c. If pain/disability persists > 2 weeks
    d. If pain/disability persists > 1 month
    e. Only if neurologic symptoms are present
    f. Never

16. In your experience, what is the average length of practice time loss, in days, for an athlete assessed with mechanical low back pain?

    -Subjects were provided an open blank in the online version, categories were created based on responses.

17. In your experience, what is the average length of competition time loss, by number of events, for an athlete assessed with mechanical low back pain?
    -Subjects were provided an open blank in the online version, categories were created based on responses.

18. Do you read peer-reviewed literature related to low back pain, injury and rehabilitation?
    a. Yes
    b. No

19. If you answered "YES" to the previous question, please list the journals you refer to for low back pain injury and rehabilitation.

20. Do you or other athletic trainers on staff perform lumbar mobilization techniques for treatment of low back pain?
    a. Yes
    b. No

21. Have you ever personally been treated by a chiropractor?
    a. Yes
    b. No

22. Have you ever worked professionally with a chiropractor?
    a. Yes
    b. No

23. Does your institution use a chiropractor in an official capacity as part of its staff?
    a. Yes
    b. No

24. If you answered "NO" to the previous question, would you utilize a chiropractor's services if there were one employed on staff?
    a. Yes
    b. No

25. Have you ever referred an athlete with low back pain to a chiropractor for treatment?
    a. Yes
    b. No

26. About how many of your athletes seek chiropractic services outside of referral from medical staff?
    a. All athletes
    b. Most athletes
    c. About half of athletes
    d. Some athletes
    e. No athletes

27. Do your athletes utilize chiropractors for pre-game manipulations?
    a. Yes
    b. No

28. If you answered "YES" to the previous question, what is/are the reason(s) these athletes receive pre-game manipulations?
    -Subjects were provided an open blank in the online version, categories were created based on responses.

29. In the event of publication, please provide your consent for the use of your anonymous answers associated with this survey. (Again, no identifiable information will be made available and in no way will anyone be able to link you to your responses.)
    a. Yes, I provide my consent to the author for the use my anonymous responses in the event of publication.
    b. No, Please do not use my responses.

30. Please use the below space to provide any feedback that you feel necessary. Feel free to provide comments about this survey as a whole, about individual questions, or anything you feel is important. Thank you again for your time and help.
    -Subjects were provided a blank writing space to communicate comments.

Appendix B – Email Cover Letter

Dear Collegiate Certified Athletic Trainer:

My name is Adam Lepley. I am a Certified Athletic Trainer and am working my Masters' Thesis at The University of Minnesota. I am contacting you to request your participation in the research project described below. The purpose of this study is to gather information from collegiate certified athletic trainers regarding their treatment of low back pain and perception and utilization of chiropractic services. This information will prove useful to the profession of athletic training to help better understand both the treatment of low back pain and the role chiropractic medicine plays among the sports medicine team. Although every effort will be taken to ensure the confidentiality of your responses, all Internet-based communication is subject to the remote likelihood of tampering from an outside source. IP addresses will not be investigated and data will be removed from the server.

1. If you decide to take part in this study, your participation will involve completing a survey pertaining to your treatment of low back pain and perceptions of chiropractors/chiropractic medicine. Please complete the survey, it should take approximately 5-10 minutes to complete.
2. Your part in this study is confidential. Scientific reports will be based on group data and will not identify you or any individual as being in this project.
3. The decision to participate is freely yours. You do not have to participate and you can refuse to answer any question.
4. If you have questions about the study, you can contact the investigator, myself, Adam S. Lepley, ATC, by phone at 989-385-0722, or by email at leple013@umn.edu.

Your completion of this survey implies your consent to participate in this study.

To access the survey, please click below (If the link does not work, please copy and paste the URL into your web browser):
http://www.surveymonkey.com/s/YH2NSR7

Thank you for your time and consideration.

Sincerely,
Adam S. Lepley, ATC

Participants for this survey were selected at random from the NATA membership database according to the selection criteria provided by the student doing the survey. This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA's commitment to athletic training, education and research.

Appendix C – Reminder Email Cover Letter

Dear Collegiate Certified Athletic Trainer:

This email is being sent to all possible research subjects who were selected to participate in this study. To those of you who have not yet been able to complete the survey, I am sending this email as a friendly reminder; and to encourage you to participate in this research project at your convenience. To those of you who have completed the survey, I thank you for your time and assistance; it is greatly appreciated. As a refresher, my name is Adam Lepley and I am a Certified Athletic Trainer who is currently working my Masters' Thesis at The University of Minnesota. The above stated survey is intended to gather information from certified athletic trainers regarding their treatment of low back pain and perception and utilization of chiropractic services. Although every effort will be taken to ensure the confidentiality of your responses, all Internet-based communication is subject to the remote likelihood of tampering from an outside source. IP addresses will not be investigated and data will be removed from the server.

To access the survey, please click below (If the link does not work, please copy and paste the URL into your web browser):
http://www.surveymonkey.com/s/YH2NSR7

If you have questions about the study, you can contact the investigator, myself, Adam S. Lepley, ATC, by phone at 989-385-0722, or by email at leple013@umn.edu.

Your completion of this survey implies your consent to participate in this study. The University of Minnesota IRB approved this survey.

Thank you again for your time and consideration.

Sincerely,
Adam S. Lepley, ATC

Participants for this survey were selected at random from the NATA membership database according to the selection criteria provided by the student doing the survey. This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA's commitment to athletic training, education and research.

Appendix D – Breakdown of Results by Question

Question 1: Are you a certified athletic trainer?

All of the 151 subjects that were surveyed answered, "Yes," and reported being certified athletic trainers.

Question 2: How many years have you been certified?

The subjects reported being certified for an average of 10.1 years with a range from 1 year to 35 years.

Question 3: Did you receive your Athletic Training degree from a CAATE accredited program? If "No," please specify how certification was achieved.

One hundred-eleven of the 151 (74.0%) subjects were certified through the current Commission on Accreditation of Athletic Training Education (CAATE). The remaining 39 (26.0%) were certified through the old internship route that was once offered.

Question 4: What is the highest degree of education you have completed?

Thirty-two (21.2%) of those surveyed had completed their bachelor's degree, 116 (76.8%) had received their master's degree, and 3 (2.0%) had received their doctorate.

Question 5: Of the following sport assignments please specify the sport teams that consume most of your time. (Mark a 1 for the team you spend the most time with, 2 for secondary assignment, etc.)

The most reported sport assignment was football, with 50 subjects (33.1%) claiming it as a primary assignment. It was also the most selected sport with 76 subjects covering football in some capacity. Basketball also had a high selection as a primary sport, with 37 (24.5%) subjects having the sport consume the majority of their time.

Tennis was the most reported secondary assignment with 20 subjects (13.2%) reporting secondary tennis coverage. The most common sports revealed in the "Other" category were volleyball, lacrosse, cheerleading, golf, crew and a rehabilitation assignment. Volleyball, (20 subjects) was the most reported "Other" sport. The distribution of sport assignment can be more easily reviewed in Table 1.

Question 6: At what level does your current institution or specific sport compete in?

a. Division I: 78.8% (119)

b. Division II: 12.6% (19)

c. Division III: 6.0% (9)

d. Other: 2.6% (4) – All reported NJCAA

Question 7: How well do you agree with the following statement: "Low back pain is common in college athletics."

a. Strongly Agree: 32.5% (49)

b. Agree: 64.9% (98)

c. Neither Agree or Disagree: 1.9% (3)

d. Disagree: 0.6% (1)

e. Strongly Disagree: 0% (0)

Question 8: How well do you agree with the following statement: "Low back pain is a common injury causing an athlete's career to end."

a. Strongly Agree: 0% (0)

b. Agree: 14.6% (22)

c. Neither Agree or Disagree: 28.5% (43)

d. Disagree: 47.7% (72)

e. Strongly Disagree: 9.2% (14)

Question 9: What do you estimate is the percentage of low back pain compared to all athletic injuries as a whole?

This next question was left open ended and categories were created after collecting responses. Based on subject's answers, the following categories were developed: < 5%, 5-10%, 11-15%, 16-20% 21-25%, > 25%.

a. < 5%: 1.1% (1)

b. 5-10%: 36% (55)

c. 11-15%: 12% (18)

d. 16-20%: 22% (33)

e. 21-25%: 7% (11)

f. >25%: 22% (33)

The final category had an average response of 37% and a range from 33-75%.

Question 10: What is your preferred method of treatment for mechanical low back pain? (Please list in numerical order, with the highest preferred treatment as 1).

In this question, the subjects could rank treatment choices from 1-8, with the highest preferred treatment as a one. After selecting a treatment as number 1, they did not have to rank other treatments and could select "N/A" or leave it blank. The treatment options included manual therapy, manipulation, complimentary and alternative medicine (CAM), modalities, corticosteroid injections, oral anti-inflammatory medication, core strengthening/stabilization and stretching. All 151 subjects marked a number 1 response meaning it is their highest regarded treatment for low back pain. The results were: 19 (12.5%) selected manual therapy, 1 (0.7%) selected manipulations, 1 (0.7%) selected

CAM, 36 (23.8%) selected modalities, 0 (0%) selected corticosteroid injections, 5 (3.3%) selected oral anti-inflammatory medicine, 70 (46.4%) selected core strengthening/stabilization, and 19 (12.5%) selected stretching as their number 1 preferred treatment. Also of note, CAM treatment was seen as the treatment most selected as "N/A," as 20 (13.2) subjects chose this response. The answers to question 10 can be more easily determined by viewing Table 2. Also, in Table 3, you can find the rankings by preferred treatment.

Question 11: Which treatment of low back pain do you feel contributes the most to the success of the athlete's rehabilitation?(Also outlined in Table 4.)

a. Core Strengthening/Stabilization: 66.2% (100)

b. Manual Therapy (ART, Muscle Energy, GRASTON, etc.): 13.9% (21)

c. Stretching: 8 (13)

d. Modalities (TENS, ultrasound, cryotherapy, etc.): 4.6% (7)

e. Rest: 4.6% (7)

f. Manipulations (Chiropractor): 1.3% (2)

g. Oral Anti-inflammatory medications: 0.7% (1)

h. Complementary and alternative medicine (acupuncture, etc.): 0.0% (0)

i. Corticosteroid injections: 0.0% (0)

Question 12: Have you ever referred an athlete suffering from low back pain to a Physical Therapist (PT) for treatment or evaluation?

a. Yes: 49.0% (74)

b. No: 51.0% (77)

Question 13: If you answered "YES" to the previous question, briefly describe the reasons for referral and procedures performed.

This next question asked those who answered, "Yes," for the reason of referral and procedures performed and were provided a free space to write their responses. A variety of responses were collected including that the ATC had not seen progress from the athlete; using PT's that specifically work with low back; use of exercises/therapies not able to be performed by ATC (McKenzie method, Muscle energy, Active Release Technique, GRASTON etc.); Postural/gait assessment; and because the PT was a trusted colleague.

Question 14: How often do you perform X-ray imaging on athletes with low back pain?

a. Immediately: 2.0% (3)
b. If pain/disability persists > 1 week: 23.2% (35)
c. If pain/disability persists > 2 weeks: 33.8% (51)
d. If pain/disability persists > 1 month: 29.8% (45)
e. Only if neurologic symptoms are present 10.6% (16)
f. Never 0.7% (1)

Question 15: How often do you perform Magnetic Resonance Imaging (MRI) on athletes with low back pain?

a. Immediately: 1.3% (2)
b. If pain/disability persists > 1 week: 2.6% (4)
c. If pain/disability persists > 2 weeks: 15.2% (23)
d. If pain/disability persists > 1 month: 23.8% (36)
e. Only if neurologic symptoms are present 57.0% (86)

f. Never 0% (0)

Question 16: In your experience, what is the average length of practice time loss, in days, for an athlete assessed with mechanical low back pain?

The subjects were asked next on the survey to report, in their experience, the average length of practice time lost in days for an athlete with mechanical low back pain. This was presented as an open-ended question; therefore, categories were made afterwards based on their responses including 0 to 3 days, 4 to 6 days, 7 to 10 days, or >10 days. Also, there was a significant portion of subjects who expressed that this time loss can vary and did not insert an estimated number; therefore this was included as a category as well. Forty-two (27.8%) suggested practice time loss from 0 to 3 days, 43 (28.5%) reported 4 to 6 days, 34 (22.5%) from 7 to 10 days, 12 (7.9%) greater than 10 days and 20 (13.2) did not provide a number and stated that time loss varied too much to determine.

Question 17: In your experience, what is the average length of competition time loss, in number over events, for an athlete assessed with mechanical low back pain?

Similar to the last question, the next question asked to report, in their experience, the average length of competition time lost, in events, for an athlete with mechanical low back pain. This was also an open-ended question where the following categories were created based on responses: 0, 1, 2, 3, >3, and varies. Thirty-two (21.2%) reported 0 competitions lost due to low back pain, 53 (35.1%) reported 1 event, 35 (23.2%) said 2 events, 6 (4.0%) said 3 events, 5 (3.3) reports greater than 3 events and 20 (13.2%) stated

it varied too much depending on athlete, type of sport, nature of injury and when pain begins.

Question 18: Do you red peer-reviewed literature related to low back pain injury and rehabilitation?

a. Yes: 66.2% (100)

b. No: 33.8% (51)

Question 19: If you answered "Yes" to the previous question, please list the journals you refer to for low back pain injury and rehabilitation.

The subjects that answered, "Yes" were then asked to identify the journals that they referred to. All 100 subjects that responded "Yes" reported reading the Journal of Athletic Training. The next most reported journal was the American Journal of Sports Medicine (AJSM), which was referred to by 23 (23%) of the 100 ATC's that answered, "Yes." Other common reported journals were the Journal of Orthopedic and Sports Physical Therapy (JOSPT), Journal of Physical Therapy (JPT) and Journal of Strength and Conditioning Research (JSCR).

Question 20: Do you or other athletic trainers on staff perform lumbar mobilization techniques for the treatment of low back pain?

a. Yes: 49.7% (75)

b. No: 50.3% (76)

Question 21: How you personally been treated by a chiropractor?

a. Yes: 38.4% (58)

b. No: 61.6% (93)

Question 22: Have you ever worked professionally with a chiropractor?

a. Yes: 64.9% (98)

b. No: 35.1% (53)

Question 23: Does your institution use a chiropractor in an official capacity as part of its staff?

a. Yes: 47.7% (72)

b. No: 52.3% (79)

Question 24: If you answered "NO" to the previous question, would you utilize a chiropractor's service if there were one employed on staff?

Those who answered "No" (total of 79) were asked if they would utilize a chiropractor's services if there were one employed on their staff:

a. Yes: 63.3% (50)

b. No: 36.7% (29)

Question 25: Have you ever referred an athlete with low back pain to a chiropractor for treatment?

a. Yes: 77.5% (117)

b. No: 22.5% (34)

Question 26: About how many of your athletes seek chiropractic services outside of referral from medical staff?

a. All athletes: 0.0% (0)

b. Most athletes: 0.7% (1)

c. About half of athletes: 6.6% (10)

d. Some athletes: 80.1% (121)

e. No athletes: 12.6% (19)

Question 27: Do your athlete's utilize chiropractors for pre-game manipulation?

a. Yes: 14.6% (22)

b. No: 85.4% (129)

Question 28: If you answered "YES" to the previous question, what is/are the reason(s) these athletes receive pre-game manipulations?

The subjects who responded, "Yes" to question 27 were asked to provide reasons for these pre-game manipulations. The majority of responses included the fact that it was the player's preference and they said it "loosened them up," "made them feel better," or "athlete's said it helped performance."