Summer 2009

An Assessment of Athletic Training Educators' Knowledge and Calibration of Evidence-Based Diagnostic Concepts

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AN ASSESSMENT OF ATHLETIC TRAINING EDUCATORS' KNOWLEDGE AND CALIBRATION OF EVIDENCE-BASED DIAGNOSTIC CONCEPTS

by

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B.S. May 2007, Boston University

A Thesis Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirement for the Degree of

MASTER OF SCIENCE IN EDUCATION

ATHLETIC TRAINING

OLD DOMINION UNIVERSITY
August 2009

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ABSTRACT

AN ASSESSMENT OF ATHLETIC TRAINING EDUCATORS' KNOWLEDGE AND CALIBRATION OF EVIDENCE-BASED DIAGNOSTIC CONCEPTS

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Evidence-based practice (EBP) is a phenomenon that has transitioned into various medical and allied health professions over the past several decades. The purpose of this study was to assess knowledge and calibration levels of evidence-based concepts in athletic training educators, as well as determine the effectiveness of an EBP single-day workshop. All educators attending the 2009 Athletic Training Educators' Conference (N=498) were solicited to participate in this study; 62 male (41.32 ± 8.92) and 79 female (36.08 ± 7.91) responded for a response rate of 28.3% (years of AT teaching experience = 9.81 ± 7.19). A twenty question multiple choice and twenty-two likert scale assessment survey was developed to measure knowledge, comfort, and importance levels concerning eleven fundamental EBP concepts. In addition, a questionnaire was utilized to collect multiple demographic characteristics that could have an effect on knowledge scores. The instrument was reviewed by a panel of experts and then pilot tested with a selected group of athletic training educators. Subjects scored a mean percentage of 64.4 ± 13.48 on the knowledge section with a range of 30.00 – 90.00. The mean score for the comfort section was 2.4 ± 0.65 with a range of 1.00 – 4.00. The mean score for the importance section was 3.3 ± 0.48 with a range of 1.81 – 4.00. In regards to the single-day workshop, there was no difference in pre-workshop (66.00 ± 13.29) and post-workshop (69.50 ± 9.26) composite knowledge percentages. There was also no difference in pre-workshop (2.46 ±

0.70) and post-workshop (2.95 ± 0.59) composite comfort scores. Finally, there was no difference in pre-workshop (3.42 ± 0.24) and post-workshop (3.42 ± 0.45) composite importance scores. The results suggest that athletic training educators may benefit from further education in evidence-based practice via workshops and short-courses. Further research should include the creation of additional single-day workshops and then examine their effectiveness on athletic training educators as well as clinicians.

This thesis is dedicated to those individuals that have believed in me over the last several years. Mom, Dad, Michael and all of my family and friends – thank you for believing in me along with your constant love and support which has helped me in achieving my goals. Bonnie, Jimmy, Mark, and Sara – your mentorship and guidance through the years have taught me many invaluable lessons in both my career and life; for that I will forever be thankful. Finally to Sarah, Dorice, and Lauren – thank you for standing by my side through all the bumps in the road; I would not be where I am today without your friendship and love.

Each of you has played such a significant role in allowing me to be the best I can be. Thank you – with all my heart.

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CHAPTER I

INTRODUCTION

Evidence-based practice (EBP) has evolved over the twenty-first century to become a lasting trend for providing care in the allied health professions. Several professional organizations have refocused their practices to include a greater emphasis on the importance of evidence-based fundamentals as a means for improving the level of health care offered to the patients (Fineoutoverholt, Melnyk, & Schultz, 2005). However, one of the greatest difficulties for clinicians to adopt EBP is the lack of knowledge and awareness on how it should be properly conducted and integrated into health care.

The integration of the best available research evidence, patient values, and clinician expertise used for making clinical decisions most accurately describes the term evidence-based practice (Forrest & Miller, 2002; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996; Steves & Hootman, 2004). EBP is conducted in a five step process: defining a clinical question, conducting a search of the most current literature, critically appraising the literature, relating the research back to the initial clinical question, and finally evaluating the effectiveness of the outcomes. Although this research evidence aims to shift health care away from traditional practice, it does not ignore the importance of a clinician's individual knowledge and clinical experience (Shlonsky, 2004).

As evidence-based practice becomes more popular throughout health care, it is important for all allied health care professionals to accept and implement this fundamental idea into clinical practice and education. Medicine, dental medicine and nursing have become the pioneering professions to adopt and utilize evidence-based practice into everyday health care. Over the past decade, accrediting bodies, governing agencies and health care payers have emphasized the push towards EBP (DePalma, 2007; Fineoutoverholt, et al., 2005; Zinberg, 1997). Not only becoming increasingly prevalent in clinical practice, evidence-based practice has flourished in nursing education as well as professional publications. Several journals have been created over the past several years solely focusing on evidence-based nursing practice. Other allied health professions, such as physical therapy, occupational therapy and athletic training have gradually begun to adopt and incorporate evidence-based practice into daily practices and education (Kronenfeld, et al., 2007).

Evidence-based practice is crucial for the advancement of the athletic training profession in the coming years. Compared to other allied health professions, athletic training as a whole is lacking in evidence-based publications identifying research to support its clinical practices (Steves & Hootman, 2004). Having scientific evidence will not only support the effectiveness of athletic training clinical methods, but may also provide reasoning for the acquisition of third-party financial reimbursement (Hertel, 2005). From an academic standpoint, it is important for educators in athletic training programs to prepare the students with the proper skills for evidence-based practice (Romanello & Martin, 2006).

The level of evidence-based practice knowledge by athletic training educators needs to be evaluated. Current literature of evidence-based practice within athletic training is limited; the majority of publications solely focus on the definition and fundamental steps of evidence-based practice (Delwiche & Hall, 2007; Steves & Hootman, 2004). Very few studies emphasize actual techniques of implementing EBP into athletic training clinical practice (A. R. Snyder, et al., 2008; Valovich McLeod, et al., 2008; C. Welch, Yakuboff, & Madden, 2008). Recognizing the current knowledge and understanding of EBP principles among athletic training educators will help to formulate new strategies and effective techniques to implement evidence-based practice into athletic training education curricula.

Statement of the Problem

The purpose of this study is to determine the knowledge and calibration (i.e. comfort and importance) levels of evidence-based practice concepts and principles by athletic training educators. Additionally, this study will examine the effectiveness of a pilot workshop designed to provide information related to the evaluation of EBP concepts linked to diagnostic testing, and the conceptualization of why these components are essential within the teaching of skills to improve patient assessment.

Experimental Hypotheses

1. *Null Hypothesis 1*: There will be no differences in knowledge, comfort, and importance level scores between athletic training educators, regardless of a terminal degree, on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment*.
    a. *Research Hypothesis 1a*: Athletic training educators with a terminal degree (i.e., PhD, EdD) will have higher pre-workshop knowledge percentages on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators without a terminal degree.

b. *Research Hypothesis 1b*: Athletic training educators with a terminal degree (i.e., PhD, EdD) will have higher pre-workshop comfort scores on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators without a terminal degree.

c. *Research Hypothesis 1c*: Athletic training educators with a terminal degree (i.e., PhD, EdD) will have higher pre-workshop importance scores on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators without a terminal degree.

2. *Null Hypothesis 2:* There will be no difference in knowledge, comfort, and importance level scores between athletic training educators, regardless of the number of hours per week spent on research, on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*

   a. *Research Hypothesis 2a*: Athletic training educators who conduct more than five hours of research per week will have higher pre-workshop knowledge percentages on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators who conduct less than five hours of research.

   b. *Research Hypothesis 2b*: Athletic training educators who conduct more than five hours of research per week will have higher pre-workshop comfort scores on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators who conduct less than five hours of research.

c. *Research Hypothesis 2c*: Athletic training educators who conduct more than five hours of research per week will have higher pre-workshop importance scores on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators who conduct less than five hours of research.

3. *Null Hypothesis 3*: There will be no difference in knowledge, comfort, and importance level scores between athletic training educators, regardless of the number of "evidence-based"-related workshops previously attended, on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*

   a. *Research Hypothesis 3a*: Athletic training educators who have previously attended "evidence-based"-related workshops will have higher pre-workshop knowledge percentages on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators who have never attended an "evidence-based"-related workshop.

   b. *Research Hypothesis 3b*: Athletic training educators who have previously attended "evidence-based"-related workshops will have higher pre-workshop comfort scores on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators who have never attended an "evidence-based"-related workshop.

   c. *Research Hypothesis 3c*: Athletic training educators who have previously attended "evidence-based"-related workshops will have higher pre-workshop importance scores on the *Evidence-Based Concepts for Clinical*

Practice Assessment than athletic training educators who have never attended an "evidence-based"-related workshop.

4. *Null Hypothesis 4*: There will be no difference in knowledge, comfort, and importance level scores between athletic training educators, regardless of the number of years of athletic training teaching experience, on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*
    a. *Research Hypothesis 4a*: There will be a positive relationship between the number of years of athletic training teaching experience and knowledge percentages on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*
    b. *Research Hypothesis 4b*: There will be a positive relationship between the number of years of athletic training teaching experience and comfort scores on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*
    c. *Research Hypothesis 4c*: There will be a positive relationship between the number of years of athletic training teaching experience and importance scores on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*
5. *Null Hypothesis 5*: There will be no difference in knowledge, comfort, and importance level scores between athletic training educators, regardless of the number of hours per week spent on academic work, on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*

a. *Research Hypothesis 5a*: There will be no differences in knowledge percentages on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment* between athletic training educators who spend more than forty hours per week spent on academic coursework and educators who do not.

b. *Research Hypothesis 5b*: There will be no differences in comfort scores on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment* between athletic training educators who spend more than forty hours per week spent on academic coursework and educators who do not.

c. *Research Hypothesis 5c*: There will be no differences in importance scores on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment* between athletic training educators who spend more than forty hours per week spent on academic coursework and educators who do not.

6. *Null Hypothesis 6*: There will be no difference in knowledge, comfort, and importance level scores between athletic training educators, regardless of the number of hours per week spent on patient care, on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment.*

    a. *Research Hypothesis 6a*: There will be no differences in knowledge percentages on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment* between athletic training educators who perform patient care on a weekly basis and educators who do not.

    b. *Research Hypothesis 6b*: There will be no differences in comfort scores on the pre-workshop *Evidence-Based Concepts for Clinical Practice*

Assessment between athletic training educators who perform patient care on a weekly basis and educators who do not.

c. *Research Hypothesis 6c*: There will be no differences in importance scores on the pre-workshop *Evidence-Based Concepts for Clinical Practice Assessment* between athletic training educators who perform patient care on a weekly basis and educators who do not.

7. *Null Hypothesis 7*: There will be no differences in knowledge, comfort, and importance level scores following the implementation of an evidence-based concepts pilot workshop.
   a. *Research Hypothesis 7a*: Knowledge percentages will increase following the implementation of an evidence-based concepts pilot workshop.
   b. *Research Hypothesis 7b*: Comfort scores will increase following the implementation of an evidence-based concepts pilot workshop.
   c. *Research Hypothesis 7c*: Importance scores will increase following the implementation of an evidence-based concepts pilot workshop.

Independent Variables

The independent variables of this study are listed as the following:

1. Demographic characteristics of athletic training educators:
   a. Terminal degree
   b. Hours per week spent on research
   c. "Evidence-based"-related workshops previously attended
   d. Years of athletic training teaching experience

e. Hours per week spent on academic work

f. Hours per week spent on patient care

e. Time (2)

i. Pre-Workshop

ii. Post-Workshop

Dependent Variables

The dependent variables of this study are the percentages and scores produced by the responses of the subjects on the knowledge, comfort, and importance scales of the *Evidence-Based Concepts for Clinical Practice Assessment*.

Operational Definitions

1. Evidence-Based Practice is the integration of the best available research evidence, patient values, and clinician expertise to make clinical decisions (Forrest & Miller, 2002; Sackett, et al., 1996; Steves & Hootman, 2004).

2. The Commission on Accreditation of Athletic Training Education (CAATE) is the governing board responsible for developing, maintaining and promoting the minimum standards of quality for athletic training education programs. An institution must adhere to these standards in order to be recognized as a CAATE accredited athletic training education program. Furthermore, via comprehensive and annual review processes, CAATE is responsible for the evaluation of a program's compliance with the standards (CAATE Accreditation Standards, 2008).

3. Undergraduate Entry Level Athletic Training Education Programs (ATEP) are entry-level athletic training education programs that use a competency-based approach in both the classroom and clinical settings. Using a medical-based education model, athletic training students are educated to serve in the role of physician extenders, with an emphasis on clinical reasoning skills. Educational content is based on cognitive (knowledge), psychomotor (skill), affective competencies (professional behaviors) and clinical proficiencies (professional, practice-oriented outcomes) ("Athletic Training Education Overview," 2008).

4. Athletic Training Education Program Director is the person recognized by the department of the institution possessing the responsibility for the accountability of the day-to-day operation, coordination, supervision, and evaluation of all aspects of the athletic training education program (CAATE Accreditation Standards, 2008).

5. Athletic Training Education Instructor is any qualified person listed by the institution as the instructor of record for athletic training didactic curriculum courses.

6. Athletic Training Clinical Instructor also known as a athletic training clinical supervisor is a certified athletic trainer who teaches, evaluates and supervises athletic training students in their field experiences ("CAATE Clinical Education Terminology," 2009).

7. Athletic Training Didactic Curricula are foundational and professional courses athletic training students of CAATE accredited athletic training programs must complete prior to commencement. Foundational courses include human anatomy, human physiology, exercise physiology, kinesiology/biomechanics, nutrition, statistics and research design, strength training and reconditioning, and acute care of injury and illness. Professional

courses include risk management and injury/illness prevention, pathology of injury/illness, assessment of injury/illness, general medical conditions and disabilities, therapeutic modalities, therapeutic exercise and rehabilitation, health care administration, weight management and body composition, psychosocial intervention and referral, medical ethics and legal issues, pharmacology, and professional development and responsibilities ("Athletic Training Education Overview," 2008).

8. Evidence-Based Concepts for Clinical Practice Assessment is a survey of 20 items assessing knowledge of evidence-based concepts, 11 items assessing comfort of evidence-based concepts, and 11 items assessing importance of evidence-based concepts.

Assumptions

The following is a list of basic assumptions that can be associated with this study:

1. The athletic training educators answered the survey honestly.
2. The survey reached the subjects and was completed by the appropriate individual.
3. The options for the answers were applicable to every subject.
4. The instrumentation used in the study was valid and reliable.
5. The athletic training educators' answers were strictly due to their own knowledge and experience and not external sources.
6. The athletic training educators' attitudes and/or other influences did not manipulate their responses on the assessment.

Limitations

There are several limitations to this study:

1. The type of environment in which the subject took the survey was not controlled.
2. The ability of the subjects to understand the questions and directions was not controlled.
3. The amount of time for completing the survey varied.
4. Whether the survey was completed in one sitting or over the course of time was not controlled.
5. The subjects could not be randomly selected.

Delimitations

1. This study was delimited to athletic training educators registered for the 2009 Athletic Training Educators' Conference
2. The post-workshop assessment of this study was delimited to athletic training educators that attended the 2009 Athletic Training Educators' Conference pre-conference workshop entitled, *Evidence-Based Concepts for Clinical Practice: A Study Investigating the Effectiveness of a Single-Day Workshop.*

CHAPTER II

REVIEW OF LITERATURE

The following is a detailed review of literature concerning evidence-based practice and its relationship to undergraduate athletic training education. While several publications have both defined evidence-based practice and proposed its importance for adoption into the athletic training profession, there is a need for research to examine the present levels of evidence-based practice awareness as well as current methods of implementation in CAATE accredited athletic training programs. While the athletic training profession as a whole gradually begins to adopt evidence-based practice within clinical practice, it is important that educators possess the knowledge and abilities to utilize evidence-based concepts within the athletic training curriculum. This chapter serves to identify the evolution of athletic training education, the history and process of evidence-based practice, the role of evidence-based practice in other allied health professions, and lastly to review different teaching strategies as well as the implications and challenges of incorporating evidence-based practice into CAATE accredited athletic training programs.

Evolution of Athletic Training Education

History of Athletic Training

The athletic training profession is still considered relatively young and new when compared to similar allied health professions such as physical and occupational therapies. The National Athletic Trainers' Association (NATA), founded in 1950, developed a purpose statement to "build and strengthen the profession of athletic training through the exchange of ideas, knowledge, and methods of athletic training (O'Shea, 1980). Shortly after the launch of the NATA, the Committee on Gaining Recognition was developed to focus on athletic training education and enhancement of the profession (Delforge & Behnke, 1999). By 1959, the committee received approval from the NATA board of directors for an athletic training educational program. Curricula for this program entailed instruction in biology, anatomy, human and exercise physiology, physics, psychology, nutrition, basic and advanced techniques of athletic training, first aid and safety, laboratory practices, as well as other courses. Although the athletic training education program was a new area of interest in the late 1950's and early 1960's, the curriculum was comprised of course work that most often already existed in physical education and health departments of four-year colleges and universities (Delforge & Behnke, 1999). Currently, even though athletic training education programs are gaining dignity as an independent major, approximately 70% of ATEPs are still housed within kinesiology or human performance departments (Charles-Liscombe, 2007).

The newly approved curriculum in 1959 had two major focus areas that would enhance an athletic trainer's marketability. The first emphasis was for athletic trainers to acquire a secondary-level teaching credential, due to the large demand of employed athletic trainers at the high school levels. The secondary-level focus was primarily in health or physical education and the athletic training curriculum included prerequisites on top of the athletic training courses to attain such a credential. The second emphasis of this educational program was to include prerequisite courses for physical therapy. The purpose of the inclusion of these classes was to again increase professional development and marketability (Delforge & Behnke, 1999).

In 1969, after a ten year gap from the approval of the first athletic training education program, the Committee on Gaining Recognition (by then known as the Professional Advancement Committee) had divided into two sections: the Subcommittee of Professional Education and the Subcommittee on Certification (Delforge & Behnke, 1999; Grace, 1999). During this time, the Professional Education Committee recommended that the NATA recognize four universities across the country (Mankato State University, Indiana State University, Lamar University, and the University of New Mexico) as providing the first undergraduate athletic training education programs. This recognition thus initiated the NATA athletic training education program evaluation and approval process (Delforge & Behnke, 1999).

By the end of the 1960's, the importance of a prepared athletic trainer was recognized by the American Medical Association (AMA) (Newell, 1984). Only one year after the first four undergraduate athletic training education programs were recognized by the NATA, the NATA Certification Committee, formerly known as the Subcommittee on Certification, administered the first certification examination (Delforge & Behnke, 1999; Grace, 1999). However, during this time the certification examination was only one of four ways in which an individual could become a certified athletic trainer. Graduation from a school of physical therapy, completion of an internship program or a special consideration route which involved at least five years as an actively participating athletic trainer were also established ways to attain certification. Also in the early 1970's, the first graduate athletic training education programs emerged at the University of Arizona and Indiana State University (Delforge & Behnke, 1999; Grace, 1999).

The twelve years following the recognition of the first undergraduate athletic training education program and the commencement of the certification examination, an abundant number of ATEPs emerged (Delforge & Behnke, 1999). By 1982, fifty-eight new athletic training education programs were developed making a total of sixty-two programs. Likewise, nine graduate athletic training education programs were formed during this time. As a result, athletic training as a profession began to assume its own identity and the need for prerequisites for physical therapy programs began to fade. By the mid 1970's a revised curriculum was established including courses more applicable to athletic training. This new curriculum included more coursework in areas such as applied anatomy and kinesiology as well as competency skill checklists to guide an athletic training student's clinical development. A requirement of a minimum of six hundred clinical hours under direct supervision of a NATA-certified athletic trainer also became mandatory (Delforge & Behnke, 1999).

The early 1980's initiated the proposal of an athletic training major and by 1986 only those education programs that met the credentials would obtain NATA approval (Delforge & Behnke, 1999). To continue professional growth and gaining recognition as an individualized major, in 1988 the NATA Board of Directors sought accreditation of entry-level athletic training education programs by the AMA Committee of Allied Health Education and Accreditation (CAHEA). First however, the AMA had to recognize athletic training as an allied health profession, which was not successfully accomplished until 1990.

By the end of 1990, the Joint Review Committee on Educational Programs in Athletic Training (JRC-AT) was assembled and included representatives from the

Academy of Family Physicians, the American Academy of Pediatrics, AMA, NATA, and in 1995 the American Orthopaedic Society for Sports Medicine (Delforge & Behnke, 1999). One of the initial tasks of the JRC-AT was to develop standards and guidelines for CAHEA accreditation. In 1994, Barry University and High Point University became the first two entry-level ATEPs accredited by CAHEA. Accreditation via CAHEA was short-lived however, and within a few years the Commission on Accreditation of Allied Health Education Programs (CAAHEP) became the governing accreditation board for entry-level athletic training education programs (Delforge & Behnke, 1999).

As time progressed, the various approaches to seek certification began to diminish. As recommended by the NATA Education Task Force, by 2004 the only way to become eligible for the BOC examination was for the candidate to successfully complete a CAAHEP-accredited entry-level athletic training education program (Perrin, 2007). Currently, athletic training students are required to complete a minimum of two years of clinical education at various settings such as colleges/universities, secondary schools, hospitals, industrial settings and sports medicine clinics under the direct supervision of an Approved Clinical Instructor. As of 2006, the Commission on Accreditation of Athletic Training Education (CAATE) replaced CAAHEP and now governs over 360 ATEPs (CAATE, 2009).

The future of athletic training education programs already holds promising changes. The NATA Educational Degree Task Force made recommendations that were then mandated by the NATA that no later than the 2014-2015 academic year, individuals entering the profession must have a degree specifically in athletic training. Such a degree is essential for the recognition of athletic trainers' education. Throughout much debate to parallel athletic training with other allied health care professions, the task force also recommended that the minimum entry level into this profession remain at the baccalaureate level (Perrin, 2007).

Program Directorship

As athletic training education programs progressed throughout the end of the twentieth century and into the twenty-first century, there became a need for a leadership position. Prior to the 1970's, all responsibility for athletic training education was left to the head athletic trainer and team physician (Leard, Booth, & Johnson, 1991). Thus, an athletic training education program director position (ATEPD) was created. Currently, the Commission on Accreditation of Athletic Training Education standards requires the ATEPD assignment to have a full-time faculty position with all rights, responsibilities and privileges as defined by the institution. They must also have programmatic and administrative responsibility as well as the appropriate release workload that is necessary to complete such administrative tasks of the assignment (Sexton, 2008).

Primarily, the main responsibilities of this position, which originally was still held by the head athletic trainer, were the administration of the education program in addition to the administration of health care to the athletes (Sciera, 1981). However, as the position of the ATEPD became more defined, responsibilities began to transform. Currently, there has become a trend that most colleges and universities are hiring individuals for the ATEPD with both athletic training certification and a terminal degree. Therefore, program directors are taking on more tenure-track appointments then previous years (Perkins & Judd, 2001). Thus, it is important for ATEPD's to fully understand the tenure and promotion process involving individual fulfillment of teaching, research and service.

Regardless of whether a program director holds a tenure appointment, the ATEPD position has numerous duties. Presently, a program director must be able to balance the tasks of student recruitment and retention, advising, clinical education, and accreditation on top of their scholarly activity and committee work. Concurrently, a program director is also responsible for the day-to-day coordination, operation, supervision, and evaluation of both the academic and clinical education components of the athletic training education program (Sexton, 2008). More specifically, alongside budgetary and fiscal management, the ATEPD has the duty of curricula planning and development as well as organization and administration of all aspects of the educational program (Sexton, 2008). The program director therefore makes all final decisions on any aspect program delivery within the educational program. Thus, in regards to evidence-based practice, it is imperative for the ATEPD to fully comprehend the EBP process before it can be properly implemented and executed throughout both the educational and clinical components of the program.

The multiple demands and complexity of the position have significantly changed the ATEPD role to a point that it has become difficult to find the time to maintain both the quality of clinical practice as an athletic trainer as well as any requirements necessary for tenure and/or promotion (Judd & Perkins, 2004). Only 42% of program directors are clinically active on top of their other responsibilities (Perkins & Judd, 2001). Currently, ATEPDs not only have significantly less interaction time with student-athletes but also have less control of the day-to-day procedures and functions of the athletic training room. However, athletic training program directors are not alone. Program directors of other professions such as laboratory sciences have expressed concerns about the increasing weight of responsibilities (Judd & Perkins, 2004). Thus, program directors must be multifaceted with skills as leaders, health professionals, researchers, and educators (Bordage, Foley, & Goldyn, 2000).

Clinical and Educational Instructors

Clinical and educational instructors also play an important role in entry-level athletic training education programs. Educational instructors are often hired by the academic department and focus on classroom learning while clinical instructors are employed by the athletic department and are primarily found in the athletic training room or clinical setting (Carr & Drummond, 2002). Thus, both instructors play a role in the education of the athletic training student (ATS). In some colleges and universities however, a certified athletic trainer can act as both an educational and clinical instructor. According to the National Commission on Allied Health Education, the primary role of an allied health education program is to provide education to its students in both a didactic and clinical manner (Carr & Drummond, 2002). It is necessary therefore, for classroom and clinical instructors to collaborate and create a balance between education and practice that can be provided to the ATS.

Clinical education permits students to approach "hands-on" learning during real life situations involving actual patients as well as communication with other allied health professionals that make up the sports medicine team. Such situations allow students to apply theories learned in the classroom while encouraging critical thinking, problem solving and decision-making (Lauber, Toth, Leary, Martin, & Killian, 2003). The quality of clinical instruction an ATS receives is determined by the attributes of the clinical instructor. Although it contributes to a majority of their daily responsibilities (Foster & Leslie, 1992), clinical instructors serve to supervise as well as teach and evaluate necessary psychomotor skills to athletic training students during their clinical experiences (Lauber, et al., 2003). A benefit to clinical instruction throughout athletic training programs is the generally small ratio between students and clinical instructors. According to the CAATE standards and guidelines (2008), there should not be more than eight students per one clinical instructor in a given semester. This allows for more personal and individualized instructional opportunities for the athletic training student (Laurent & Weidner, 2001).

In the 2001 revised standards and guidelines, CAAHEP officially adopted the Approved Clinical Instructor (ACI) (Weidner & Henning, 2004). Currently, CAATE standards (2008) identify an ACI as any health care professional as defined by the American Medical Association and the American Osteopathic Association who has been properly credentialed for a minimum of one year, and is formally trained with the skills to effectively teach and evaluate athletic training students' clinical proficiencies. However, ACIs typically tend to be certified athletic trainers who have held BOC certification for a minimum of one year (Sexton, 2008). To remain an approved clinical instructor, the ACI must complete formal retraining at least once every three years. Formal retraining reviews the several standards, in conjunction with CAATE accreditation guidelines, that an ACI must maintain including legal and ethical behavior, communication skills, interpersonal relationships, instructional skills, supervisory and administrative skills, evaluation of performance as well as clinical skills and knowledge. Approved clinical instructors should display clinical aptitude by making sound clinical decisions as well as maintaining a systematic approach to critical thinking and problem solving (Weidner & Henning, 2004). Concurrently, the ACI should always be prepared to explain their actions and clinical decisions to an athletic training student as well as exemplify the proper role of an athletic trainer as a part of the health care team.

If a certified athletic trainer has not received formal training to become an ACI, but is interested in mentoring and supervising athletic training students throughout their clinical education experiences, they may opt to become a clinical instructor (CI). Again, according to the CAATE standards (2008), a CI is identified as an American Medical Association and American Osteopathic Association declared health care professional that has been credentialed for a minimum of one year. Unlike ACIs that must maintain the responsibility of supervision, mentorship, instruction, and most importantly evaluation of the athletic training student's clinical proficiencies however, the clinical instructor's responsibility to the ATS is solely to supervise, mentor and instruct the student during their clinical experience. Health care professionals that have not been credentialed for at least one year may still be clinical instructors, however a plan for the CI to be supervised by a properly credentialed approved clinical instructor and/or clinical instructor must be formulated to guarantee the quality of teaching and supervision provided to the athletic training student (Sexton, 2008).

It has been estimated that athletic training students perceive that 53% of athletic training professional development comes from clinical experience (Weidner & Henning, 2005). Therefore, the role and influence of the approved clinical instructor and/or clinical instructor can have a tremendous effect on a student's clinical experience. Laurent et. al (2001) examined the perceptions of helpful clinical instructor characteristics by both the clinical instructor an athletic training student. Several teaching tips for clinical instructors were thus identified. These tips include clinical instructor confidence, respect for the students, effective communication with the student as to what is expected of them, remaining accessible, willingness to admit when information is not known, and listening attentively to both students and athletes.

As with any teachable situation, an effective instructor must be able to describe a concept in multiple ways to account for the various learning styles of the students at hand. Particularly within athletic training clinical education, an approved clinical instructor and/or clinical instructor must be aware of the athletic training student's educational competency level, learning style and willingness to perform athletic training skills at all times (Meyer, 2002). Each ATS may approach a clinical situation differently, and as their emotional maturity, motivation, cognitive readiness to perform a specific task, and clinical experience level acclimates, ACIs and CIs must be confident in their own leadership skills and teaching abilities so that they may be ready to adapt to any type of clinical conflict or situation (Meyer, 2002). Thus, when approved clinical instructors as well as CIs display both leadership expertise and effective teaching strategies, they positively enhance not only the students' learning experience but also their own clinical growth (Merideth, 2007).

Similar to the role of clinical instructors, athletic training didactic instructors influence the professional development of athletic training students within the classroom. Qualifications of the athletic training educational faculty include teaching eligibility though professional preparation as well as experience in their respected fields as distinguished by the educational institution (Sexton, 2008). Educational instructors must also be recognized as a faculty member and/or instructional staff of the institution and most importantly be familiar with the *Athletic Training Educational Competencies* that are relevant to the courses they will be instructing. Instructors teaching within an athletic training education program may be other allied health professionals other than BOC certified athletic trainers, however since the 1997 National Athletic Trainers' Association's Board of Directors decision to execute a single BOC certification route, hiring ATCs as the full time athletic training educational faculty has become prominent (Starkey & Ingersoll, 2001). This faculty may be preferred in some ATEPs as they can most accurately educate and mentor students in the athletic training educational competencies that will be transferred into practices during their clinical experiences.

On a daily basis, athletic training educators focus their teachings on information and skills that are necessary for athletic training students to learn and master. Educators are constantly interacting both with students and colleagues for suggestions and constructive feedback in regards to suitable ways to instruct learners in ways that enhance their educational wellbeing (Peer & Rakich, 2000). One of the greatest accomplishments of an effective educator is to be able to grab the attention of the students and encourage them to make a commitment to learning and to strive for success (Cornesky, 1992). Particularly within athletic training, it is the didactic instructor's goal to portray athletic training skills and competencies to the ATS in such a manner that allows them to confidently and effortlessly apply their classroom knowledge to real life situations during their clinical experience.

For several years there has been a gap between what is taught in the classroom and what is practiced in the athletic training room. Although athletic training education programs have grown stronger in their didactic and clinical unity, unfortunately this gap often still exists today. In a majority of the athletic training programs, the didactic instructors are hired by the ATEP, while clinical instructors are hired by the athletic department (Carr & Drummond, 2002). Therefore, both departments share the responsibilities of educating the athletic training students. Commonly, classroom instructors juggle other program responsibilities such as advising students, administrative tasks on top of their individual research endeavors and service pursuits. These factors typically make up the majority of the instructor's workload, leaving very little to no reassignment time designated for clinical education (Hertel, West, Buckley, & Denegar, 2001). Therefore, because of their lack of presence in the clinical setting, didactic instructors often lack credibility when it comes to clinical practice (MacCormick, 1995).

A successful working relationship between academicians and clinicians must be maintained throughout an athletic training education program (Carr & Drummond, 2002). Athletic training clinicians should become involved in the didactic portion of the student's education, just as an athletic training academic instructor should remain as clinically active as possible (Weidner & Henning, 2002). Finally, in addition to maintaining a balance between the classroom and clinical setting, both didactic and clinical instructors must communicate and develop strategies in which both sides of the program can model to students the distinct ways in which classroom knowledge can be integrated into clinical practice. More specifically, academicians and clinicians should demonstrate how research evidence can be utilized in both the classroom and the clinical site (Weidner & Henning, 2002).

Terminal Degrees

As athletic training education continues to evolve to become more widely recognized as an evidence-based allied healthcare profession, its educational faculty has begun to progress as well and the need for more doctoral-educated certified athletic trainers has become indispensable (Hertel, et al., 2001). In 1997, along with the transformation to a sole certification route, the National Athletic Trainers' Association Educational Task Force initiated an Educational Council that, along with several other duties, would be a resource for the creation and implementation of athletic training doctoral programs (Force, 1997). Currently, athletic training educators in ATEPs hold varying types of degrees, academic rank, and percentages of their assignment dedicated to academics (Starkey & Ingersoll, 2001).

A terminal degree has been recommended to individuals wishing to pursue a program director assignment within athletic training (Leard, et al., 1991). However, many new terminally degreed certified athletic trainers struggle with the immediate demands and challenges of simultaneously balancing teaching, research and service responsibilities (Starkey & Ingersoll, 2001), let alone any type of additional administrative and operational components of both the academic and clinical education programs a program director would juggle (Peer & Rakich, 2000). Thus, with the push for evidence-based practice among allied healthcare professions, a terminal degree should be more widely emphasized to all certified athletic trainers, not just those seeking a program directorship. To do so however, athletic training doctoral programs need to be developed and accredited. The implementation of doctoral programs in athletic training will not only produce more terminally degreed certified athletic trainers that will help spread the knowledge base within athletic training, but it will also address the growing concern about the lack of clinical practice research in the athletic training profession (Hertel, et al., 2001).

Evidence-Based Practice

History of Evidence-Based Practice

Evidence-based practice (EBP) is a phenomenon that has become increasingly popular in health and medicine over the past several decades. In the twenty-first century clinicians in various allied health professions are beginning to make the shift from traditional medicine, experience, and intuition, to a more judicious, conscientious, and patient-centered approach to health care (Fisher & Wood, 2007; Steves & Hootman, 2004). Major professional organizations and federal agencies have shifted their focus to emphasize the importance of evidence-based practice as a means to improve health care (Fineoutoverholt, et al., 2005). Currently, the Joint Commission on Accreditation of Healthcare Organizations administratively requires evidence-based policies and procedures (DePalma, 2007), and it will not be long before other adjustments to shift towards an evidence-based practice paradigm will be made.

Evidence-based practice can be most accurately defined as the integration of the best available research evidence, patient values, and clinician expertise used to make clinical decisions (Forrest & Miller, 2002; Sackett, et al., 1996). This research evidence focuses on day-to-day patient-centered outcomes that will be most applicable to the individual needs of a patient (Steves & Hootman, 2004). It has been estimated that patient outcomes are improved by at least 28% when the clinical decisions are based from research evidence rather than traditional methods of treatment (Fineoutoverholt, et al., 2005). However, it is important to note that although EBP suggests that the traditional approach to medicine, that so many clinicians are familiar with, may no longer be entirely the best approach to health care, it does not ignore a clinician's knowledge or clinical experience (Fisher & Wood, 2007). Therefore, evidence-based practice should be utilized as a tool to assist allied health professionals in making appropriate clinical judgments that are based on patient-outcomes.

One of the greatest misconceptions of evidence-based practice is that it is a blueprint on how to practice within allied healthcare professions (Steves & Hootman, 2004). Some healthcare providers believe that EBP creates a "cookbook" approach to clinical practice (Shlonsky, 2004), and will therefore produce cookbook clinicians. What these individuals fail to comprehend, however, is that evidence-based practice is not a set of robotic guidelines for clinicians to follow, but instead an integration of three fundamental elements. Any clinician who feels that they must restrict their clinical behavior and practices to only what the evidence concludes has missed the concept of EBP (Steves & Hootman, 2004). As previously mentioned, evidence-based practice involves not only the best current research evidence, but also incorporates the clinician's individual expertise and most importantly the patient's own personal values and goals. None of these three essential rudiments can stand alone in the EBP process; all three must successfully be combined to truly define what evidence-based practice really is (Shlonsky, 2004).

Unfortunately, evidence-based practice is also becoming a catchphrase for anything within clinical practice that can somehow be linked to an experimental study, regardless of the evidence quality depicted in the study, as well as consideration of the patient's values and needs (Shlonsky, 2004). However, what many novice EBP allied health care professionals fall short to recognize is that not only does evidence-based practice take into account the best available research to support answers for everyday clinical questions, but it also encourages clinicians to search for the disconfirming evidence (Shlonsky, 2004). By identifying and weighing both sides of the literature, practitioners can therefore make stronger clinical decisions as well as be able to more accurately discuss the "pros and cons" of such choices with their patients.

A clinical decision based on the best available research is a concept that has been found in writings dating back to the mid-nineteenth century (Steves & Hootman, 2004). More recently, the notion of evidence-based practice has been coined as the hallmark of excellence throughout clinical practice (Fisher & Wood, 2007). Starting in 1972, a British epidemiologist, Dr. Archie Cochrane, began the evidence-based practice movement by criticizing the health care profession for not providing the public with access to systemic reviews of evidence. By publishing a systematic review proving that corticosteroid therapy reduced the chances of premature infant death from 50% to 30%, Dr. Cochrane established the importance of current research and providing the evidence in reviews that can be used to guide clinicians in clinical practice interventions (Fineoutoverholt, et al., 2005). Due to Dr. Cochrane's influence, the Cochrane Collaboration was established in 1993, which can be utilized to assist health care providers during the clinical decision making process. It also serves to develop systematic reviews of current research and make these analyses available to the public (Fineoutoverholt, et al., 2005). To date, the Cochrane Collaboration contains over 190,000 randomized controlled trials and is proclaimed the best and most thorough source to obtain evidence for clinical practice treatments (Bigby, 1998).

Since the commencement of the Cochrane Collaboration in 1993, several other databases, textbooks, and peer-reviewed journals have been developed to encourage healthcare providers to transform their clinical practices to include evidence-based practice. Internet tutorials have even been created to provide clinicians with short mini-courses on how to properly conduct an EBP search. For example, The Centre For Evidence-Based Medicine website (Oxford, England) contains useful tools for learning evidence-based practice as well as schedules of courses on how to utilize and teach EBP (Bigby, 1998). This website can be visited at http://cebm.net/. Other useful resources include *Evidence-Based Medicine: How to Practice and Teach EBM* written by Sackett et al. in 1996 and *A Basic Science for Clinical Medicine* also written by Sackett et al. in 1991. *A Basic Science for Clinical Medicine* provides a complete delineation of the origins and principles of evidence-based medicine (Bigby, 1998).

Steps of Evidence-Based Practice

One of the difficulties about adopting the evidence-based practice concept into health care professions is the lack of knowledge and awareness about how it should be appropriately conducted. Novice clinicians often lack the necessary skills and become frustrated when they are asked to implement evidence-based practice into their daily practices (Killeen & Barnfather, 2005). Because the Internet allows patients to effortlessly access health care and medical information, it is critical for health care professionals to remain up-to-date with the most scientific research (Forrest & Miller, 2002). The demand for clinicians to be conscious of the most efficient way to access this research is becoming a necessity. Therefore, understanding the evidence-based practice procedure is an essential step for creating the potential for the greatest patient outcomes possible (Forrest & Miller, 2002). This process requires the clinician to proceed through four fundamental steps. First, a sound clinical question must be developed which will guide the clinician in the research progression. Once this question is developed, a search for the most current literature is conducted using various search engines and databases. Next, the research is appraised for its accuracy, and finally the applicability of the evidence is determined as it relates back to the clinical question (Bigby, 1998; Craig, Irwig, & Stockler, 2001; Fisher & Wood, 2007). Current literature also suggests a fifth step to the evidence-based practice process: evaluating the clinical outcome after evidence implementation (Fineoutoverholt, et al., 2005; Forrest & Miller, 2002; Steves & Hootman, 2004).

Step One – Defining a Clinical Question

To grasp a better understanding of how to properly conduct each step of the EBP process, the following case example will be utilized: A 23-year old female recreational rower enters the athletic training room complaining of low back pain. She states that her back has been bothering her for three weeks and has noticed an increased severity of pain within the last few days. She is concerned that her pain is going to get so severe that it will ultimately inhibit her rowing and asks what you, the certified athletic trainer, can do to help alleviate her pain. After a complete evaluation of the patient you determine she has mechanical low back dysfunction and would like to research which intervention strategies can help this patient.

Developing a sound clinical question is the most important yet most difficult part of conducting evidence-based research (Bigby, 1998; Sackett, et al., 1996). A well-built question should direct an answer that is focused on patient-centered outcomes and will not only improve the quality of care, but will also increase patient satisfaction (Forrest & Miller, 2002). Conversely, a poorly written question can result in one of two situations; the clinical question is not clear enough which produces irrelevant literature, or the question is so broad that the resultant is an excessive amount of information obtained from the literature search that may be unmanageable in a given period of time (Steves & Hootman, 2004). Typically a well-constructed clinical question identifies four main components. These elements are often referred to as PICO, which identifies the population or patient problem [P], intervention or area of interest [I], comparison intervention or group [C], and lastly the outcomes [O] (Fineoutoverholt, et al., 2005; Forrest & Miller, 2002). The PICO format allows the clinician to develop a well-written question that is both specific and direct, and will allow them to easily proceed to the next step of the evidence-based practice process. Clinical questions may also be grouped into several categories such as diagnosis, therapy, prognosis, harm, and prevention, which therefore allow the clinician to further individualize their search (Bigby, 1998). These categories help guide the clinician as to which type of clinical study will constitute the best evidence available for that particular clinical question (Bigby, 1998). Developing a strong clinical question therefore allows the clinician to focus on the patient and carefully choose the best intervention for that particular individual (Bigby, 1998). The clinical question is the driving factor to a smooth evidence-based practice search. Thus, to avoid complications and a faulty start, it is crucial for the clinician to formulate a well-built, searchable and answerable question (Fineoutoverholt, et al., 2005).

One of the largest obstacles novice EBP clinicians experience while developing a PICO question is the ability to provide an adequate amount of information in each category without becoming too detailed (Forrest & Miller, 2002). To avoid such a challenge, the clinician should provide a succinct phrase for each of the four categories. It may also be useful for the clinician to form an individualized systematic approach to formulating PICO questions so that eventually developing clinical questions will become routine and second nature.

Identification of the population or patient problem [P] is the initial step in developing a well-constructed clinical question using the PICO process. Addressing the patient's chief complaint as well as pointing out the most important characteristics such as gender, age, race and previous conditions will sum up the information needed for this clinical question component (Sackett, et al., 1996). Referring back to the case example, the patient is identified as a 23-year old female who participates in rowing. Including this patient information may produce too specific of a search however, resulting in few research studies that can be related to the specific individual at hand. Therefore, the [P] portion of this clinical question can be broadened to include 'young adult athletic females'.

The second phase of the PICO process is to distinguish the intervention [I]. This step can incorporate the clinician's expertise as it allows them to identify what they plan to do for the patient whether it be a diagnostic test, type of medication or treatment, recommendation of the use of a particular procedure or adjunctive therapy (Forrest &

Miller, 2002). In the case example, the certified athletic trainer would like to research which intervention techniques will be most suitable to relieve pain for this particular patient. Therefore, a specific treatment method has not been identified and the clinical question will include a broader search for all intervention techniques to alleviate low back pain.

The comparison [C] element incorporates the clinician's consideration of another option to the type of intervention identified in the second step. This alternative can include any type of substitution, such as a similar diagnostic test or a treatment technique read about in a peer-reviewed journal, or can denote a lack of any intervention method at all. Often, there is no other alternative to the intervention method and therefore the comparison component is considered to be an optional section of the PICO process (Forrest & Miller, 2002). The female rower in the example has not been receiving any type of treatment for her low back pain prior to seeing the certified athletic trainer. Therefore, the comparison to the intervention techniques in question would be no treatment at all. Thus, instead of stating this null method in the clinical question, the comparison component can be eliminated for the question formulation.

The final portion of building a solid clinical question using the PICO format is the outcome [O]. This aspect should specify the intended result(s) of what the clinician hopes to accomplish or change as well as be measurable. Variables such as improving or maintaining a condition, and alleviating or eliminating symptoms can be included in the outcomes section (Forrest & Miller, 2002). For the female rower, the short-term outcome is to alleviate her pain while the long-term goal would be to further focus on completely eliminating her low back pain.

It has been suggested that a fifth component of the PICO formula can help to further narrow down the amount of information that may be produced from a literature search. This component focuses on the time period as it relates to the population and outcome of interest (Johnston & Fineout-Overholt, 2005). However, in some circumstances, time is not a factor of the clinical question and therefore this fifth component is often discarded in the PICO process. Returning to the case example once again, the certified athletic trainer would like to know both immediate and long term intervention strategies to help the patient. Therefore, a search for both short term and long term interventions can be conducted, or the time component can be disregarded from the clinical question so that the literature search will produce results of varying treatment durations.

Once a brief phrase has been developed for each of the four components within the PICO process, the individual elements can be pieced together to construct the finalized clinical question. To conduct a literature search for the female rower in the case example, a possible clinical question could be assembled as follows: "What are possible intervention strategies for reducing the severity of pain of mechanical low back dysfunction in young adult athletic women?" This clinical inquiry clearly identifies the population, intervention, and outcome in question and is specific but simultaneously broad enough to hopefully produce a manageable amount of research evidence.

Once a clinical question has been clearly defined, the clinician may proceed to the next step of the EBM process: Searching for the best evidence. Several years ago, the process of searching for research evidence was rather daunting. However, since the mid-1990's, rapid technological advancements have allowed easy access to electronic formats and bibliographic databases via the Internet (Bidwell, 2004; Steves & Hootman, 2004). Therefore, retrieving information no longer requires a clinician to spend hours turning pages through old medical journals in the library (Steves & Hootman, 2004). There are several places in which information can be obtained, however the ideal research exploration should include high quality data that is relevant, comprehensive and user-friendly (Craig, et al., 2001). By utilizing the clinical question, the clinician will be able to determine which databases are most suitable to search, which study designs will be most appropriate, as well as which specific keywords will be most influential in obtaining accurate and useful information (Fineoutoverholt, et al., 2005).

Step Two – Conducting a Literature Search

Although developing the clinical question may be the most crucial of the five steps to evidence-based practice, searching for accurate literature and narrowing it down to a manageable amount of information is by far the most time-intensive (Steves & Hootman, 2004). The concept of evidence-based practice would be void if research literature did not exist or was unavailable. Therefore, knowing how to search through numerous resources and minimize information to answer a clinical question is crucial for allied healthcare professionals to comprehend. Simultaneously, it is also important for the clinician to be able to appraise whether the literature found gives high quality evidence; a skill that will be described in step three of the evidence-based practice process.

Not too long ago, exploring for answers to the numerous questions clinicians came across daily was a daunting process. Searching for research often involved long hours in the library looking through medical journals, textbooks, or even the microfiche (Steves & Hootman, 2004). Today, however, quality evidence can be found almost anywhere thanks to the modern technological advances of the Internet and communication. Potential sources not only include the typical textbooks, published journals, and systematic reviews that are primarily thought of when searching for evidence, but also colleagues, experts, or even individual personal experience (Bigby, 1998). With the vast amount of available current resources, clinicians should now be able to access any type of information whenever they may need it.

While delving into the abundant amount of current literature available, it is important to remember that the ideal research evidence should not only be valid and relevant to the clinical question, but should also be user-friendly (Craig, et al., 2001). One of the benefits of a well-defined clinical question is that it makes the hunt for quality evidence more straightforward. The PICO formulated question allows the clinician to combine appropriate words and phrases, which will suit the specific query language of many on-line searching services (Bigby, 1998). However, before the necessary search terms are identified, the next obstacle of step two is determining which type of study will provide the most appropriate research evidence.

For the majority of health care providers planning to implement EBP into their clinical practice, it is not imperative to know finite details about the numerous types of study designs. However, it is important to have a general understanding of the different types of studies so that the research evidence may be properly comprehended. Several types of study designs analyze primary data and are retrospective in nature; the condition, intervention or outcome has already occurred in the past (Johnson, 2001). These study designs are described as non-experimental research and include case reports, case series and case-control. A case report is a collection of data on a single patient whereas a case series is a collection of information gathered on a particular course of treatment or intervention of individual patients (Fisher & Wood, 2007; Forrest & Miller, 2003). A case report is advantageous in that it allows a clinician to report a rare or unique clinical event whereas case series provide documentation on situations in which a new or complex intervention is used (Fisher & Wood, 2007). Generally, both case reports and case series involve a selection bias because the researcher more often than not has a direct relationship with the subject. Subjective assessment is also the most common form of analysis in these studies and therefore result in very few conclusions (Fisher & Wood, 2007). Finally, because there is no control group in either of these study designs, the reported results hold no statistical validity (Forrest & Miller, 2003). Thirdly, case-control studies involve analyzing a patient with a particular condition to similar individuals that do not have the condition. This type of study design allows for a small subject sample size, generally occurs over a short duration, and is typically used when the prognostic factors to a certain condition are being questioned (Fisher & Wood, 2007). It is important to note that this type of study is generally found to be less reliable than others because identification of a statistical difference between groups does not necessarily indicate that one condition caused another (Forrest & Miller, 2003).

Two other study designs, cohorts and randomized controlled trials, also involve primary data, however are classified as prospective studies. These studies look more at the effect of an intervention versus the initial cause. Both study designs utilize control groups, which is a major advantage to the validity of the conclusive evidence (Fisher & Wood, 2007). A cohort study is used to follow a group of subjects with a particular condition compared to another group who are not affected by the same condition over time (Forrest & Miller, 2003). Although this type of design is ideal for examining the natural course of a disease, determining risk factors of a particular condition and clarifying the outcome of a type of intervention (Fisher & Dvorak, 2005), there are several disadvantages. Cohort studies can be expensive, time-consuming, require strict inclusion and exclusion criteria and often must include subjects that agree to standardized follow-up appointments on a regular time basis (Fisher & Wood, 2007).

A randomized controlled trial (RCT) is an experimental research design that collects data from subjects using various experimental measures. It is the most well recognized study design and is considered to be the gold standard of experimental research (Fisher & Wood, 2007). A RCT involves two groups, often named the experimental group and the control group, in which subjects are typically randomly assigned. The experimental group receives the intervention in question while the control group receives an alternative treatment, placebo, or no treatment at all. Both groups are evaluated to see if any differences exist (Forrest & Miller, 2003). Although randomization eliminates selection bias, a RCT can be extremely difficult to properly execute. Disadvantages of a randomized controlled trial include subject recruitment difficulties, high costs, limited ability to generalize the results to a larger population, and are often time-consuming (Fisher & Wood, 2007). Research equipment is most often used in an RCT, which further depletes financial resources. Also, because subjects are randomly assigned to the different groups, it is difficult to ensure a demographic balance between groups (Fisher & Wood, 2007). Finally, patient compliance and mortality rates are also problematic factors to a RCT (Fisher & Wood, 2007).

Other study designs an evidence-based practice clinician should be familiar with are systematic reviews and meta-analyses. Generally, these types of studies focus on a larger picture than the previously mentioned study designs as they serve as compilations of primary data from various research studies conducted that revolve around a similar condition or intervention of interest. More specifically, these studies synthesize a large pool of data in attempt to answer a question that may not be answerable with a single research study (Fisher & Dvorak, 2005). The main criterion for merging studies into one analysis is that their combination makes practical sense and provides results that therefore can be interpreted (Green & Britten, 1998). A systematic review has explicit criteria for the retrieval and analysis of evidence collected in individual research studies (Forrest & Miller, 2003). They provide an unbiased synthesis of evidence and ensure that all research data pertaining to the subject, including everything from case reports to randomized controlled trials, is evaluated for its quality and relevance in clinical application (Petrie, 2006). Whereas randomized controlled trials are considered the gold standard for research data, systematic reviews are considered the gold standard for research evidence because they provide a method for handling large quantities of research information (Forrest & Miller, 2003). Thus, the unbiased nature of systematic reviews gives the clinician the opportunity to determine for themselves the validity of conclusions presented (Fisher & Wood, 2007).

Systematic reviews carry out qualitative syntheses of research data. Meta-analyses, on the other hand, provide a synthesis of quantitative data, most often from randomized controlled trials. Although this study design is very similar to a systematic review in regards to its formation and analysis, a meta-analysis is more of a statistical process that combines and synthesizes the statistical analyses of independent studies into a single, larger analysis (Forrest & Miller, 2003). Generally, a meta-analysis becomes useful when the statistical results of an independent study are inconclusive due to low power (Fisher & Wood, 2007). Thus, when a meta-analysis is formulated, the sample size and power of the results usually increase (Forrest & Miller, 2003).

A basic understanding of the different types of studies will aid a clinician in determining which study design will provide the most appropriate results to answer their clinical question. However, the next obstacle of a successful literature search is to figure out where the exploration should begin. Several databases are available via the internet complete with an abundant amount of full-text peer-reviewed journal articles. Often, Bradford's Law of Scattering (Delwiche & Hall, 2007) helps to identify "zone 1" journals, that is, the journals that contain the most relevant research for a distinct profession. In 2007, Delwiche & Hall performed Bradford's Law of Scattering, which revealed six journals most prevalent for athletic training. These journals, in descending order for the number of citations, included the *American Journal of Sports Medicine*, *The Journal of Athletic Training*, *Journal of Orthopaedic & Sports Physician Therapy*, *Medicine & Science in Sports & Exercise*, *Physical Therapy*, and the *Journal of Sport Rehabilitation* (Delwiche & Hall, 2007). Along with going to a journal's direct webpage to search for literature, numerous search engines provide viable options for retrieving pertinent information. Generally, particular search engines are more appropriate depending on the field. Although there are several databases utilized, some of the more popular search engines include MEDLINE, PubMed (the public access version of

MEDLINE), SPORTDiscus, and the most well known database for high quality sources, the Cochrane Database of Systematic Reviews (CDSR) (Bidwell, 2004).

The majority of search engines available have different methods for retrieving literature. Therefore, because searching skills will improve over time (Bigby, 1998), it is best to become familiar with a select few of the most pertinent databases relevant to the allied health field. For the purposes of this literature review, MEDLINE will be the selected search engine for discussion, since it includes a good range of journals related to medical research (Delwiche & Hall, 2007). More specifically, MEDLINE is the National Library of Medicine's bibliographical database and covers numerous health fields including medicine, dentistry, nursing, and various other preclinicial science fields (Bigby, 1998).

Regardless of the database used, the key to searching is to locate applicable articles and eliminate irrelevant articles (Bigby, 1998). Conveniently, techniques such as text word searching, MeSH word searching, exploding, and truncation can help to expedite the process. To begin, text word searches allow the individual to search the MEDLINE database for particular words in a title or abstract that relate to the author's intent within the article (Bigby, 1998). However, there are several flaws to this approach. If the author happens to misspell a word, the article may not appear within the search results. Furthermore, if a word is omitted from the abstract or title, the article will also not be presented in the final results (Bigby, 1998).

Medical Subject Headings, more commonly referred to as MeSH headings, are a collaboration of controlled medical vocabulary terms indexed within the MEDLINE database (Bigby, 1998). As each citation is catalogued into the MEDLINE library, it is given a specific MeSH heading(s), which will therefore continuously include the article when that particular term is being investigated (Bigby, 1998). MeSH headings also tend to have subheadings, which further delineate a particular article or group of related articles (Bigby, 1998). However, a major fault to the MeSH heading cataloging system is that the term assigned to an article may not coincide with the author's original intent of the publication (Bigby, 1998). Therefore, pertinent articles may be overlooked when a MeSH word search is being conducted.

To further increase the sensitivity of a literature search, exploding and truncating MeSH heading terms can be used (Bigby, 1998). By exploding a MeSH heading, the individual searching for articles has chosen to include all logical subheadings associated with that particular MeSH term (Bigby, 1998). Truncation on the other hand, allows the individual to search for terms by utilizing the root of the word. For example, if an individual was interested in retrieving articles about tendinopathies, they may choose to enter the search term 'tend$'. The $ symbol in this entry acts as a wildcard, and will therefore produce results for all articles that contain the root 'tend' (e.g., tendon, tendinopathy, tendinitis, tendinosis, etc.).

Along with utilizing the techniques to narrow down articles retrieved within a literature search, most databases include features that aid in limiting the number of citations collected. Specifically to MEDLINE, an individual may choose to limit a search by distinguishing the language presented, publication type, type of subjects, and year of publication (Bigby, 1998). Including or excluding such criteria will help to further refine what may already become a time-intensive searching process.

Step Three – Critically Appraising the Research Literature

The third step of evidence-based practice is critically appraising the evidence. Unfortunately, publication does not necessarily ensure the quality of a study. In fact, poor-quality studies tend to overestimate the actual benefits gained from intervention results by an estimated 30% (Moher, et al., 1998). Similarly, results gained from diagnostic tests have also been found to exaggerate the accuracy of the test being evaluated (Lijmer, Mol, & Heisterkamp, 1999). Therefore, critically appraising the evidence may be the most difficult for novice EBP clinicians because they are unfamiliar of the necessary skills to evaluate research evidence (Steves & Hootman, 2004).

The purpose of critically appraising research evidence is to determine whether the results can be translated and applied during clinical practice (Fineoutoverholt, et al., 2005). Essentially, the clinician should be able to answer three general questions for each study that is analyzed. First, what are the results of the study and are they reliable; can they be reproduced if the same study was conducted again? Second, are the results of the study valid? More specifically, did the results produce answers to what the researcher was initially looking for? And finally, are the findings of the study clinically relevant to the particular clinical question (Fineoutoverholt, et al., 2005; Forrest & Miller, 2003)? It is also important for a clinician to be able to identify the positive aspects of a study as well as the negative ones. As is human nature, no single research study is perfect. Therefore, being able to identify flaws, limitations, and threats to validity will not necessarily eliminate the study from consideration but will aid the clinician in making a thorough clinical decision (Fineoutoverholt, et al., 2005).

There are several different ways in which research can be conducted and as a result, critical appraisal must take into account the characteristics of each type of research study design previously described. Each type of design has its own advantages as well as disadvantages and it is important for the clinician to be able to recognize both. To begin the critical appraisal process, it is necessary to determine whether the type of study design utilized to answer the clinical question is appropriate and well implemented (Fisher & Wood, 2007). Simultaneously, it is important to appraise specific aspects of the research study. However, before reviewing the reported results of a study, the clinician must have a comprehensive knowledge of the statistical and evidence-based concepts most often reported in a research manuscript. In particular, there are ten concepts that are frequently discussed within research literature. These components include: p-values, confidence intervals, reliability, validity, intra-class correlation coefficients, kappa coefficients, specificity, sensitivity, likelihood ratios, and predictive values.

P-Values and Confidence Intervals

It is important to be cautious of a study's reported values of statistical difference. This difference is often a variation between comparison groups and is traditionally reported as a probability or *P* value. A *P* value is a statistical measure of strength against the null hypothesis that the results of the study occurred solely by chance (Mackinnon, 2007). Typically, the *P* value has a set alpha-level, which is a preset numerical value that indicates the probability that the results were not due to the intervention being studied but instead by chance. This level is most often set at 0.05, which permits a 95% probability that the results were not produced by chance. The P value generally ranges from zero, which indicates that the effect could never occur, to one. When the *P* value is less than the identified alpha-level the results are claimed to be statistically different. The difficulties with *P* values however, is that they are limiting in the values that they report.

This statistical measure only reflects that statistical significance and the likelihood the dependent measures differ due to chance (Cordova, 2007). Therefore, although a value may indicate on paper that a statistical significance was found, it could only be due to varying reasons such a large sample size tested in the study.

Even though a study may indicate a statistical difference, it does not necessarily mean the results will impact clinical practice. Lets consider an easy example. The results of an experimental study revealed that individuals who had received multiple hamstring injuries over time had two degrees less knee flexion than individuals who had never experienced a hamstring injury. Although such results indicate statistical significance within the study, this information may hold no true clinical relevance for a clinician trying to determine preventative methods for repeated hamstring injuries. *P* values fail to indicate the magnitude or effect the intervention actually has on the population being studied and therefore do not provide a sufficient amount of information when reported alone (Cordova, 2007). In addition, *P* values also tend to fall short of providing clinicians with the range of values in which the true intervention effect is most likely to exist (Montori, et al., 2004). Fortunately, confidence intervals can provide this lack of information. Confidence intervals (CI) are a measure of the range in which an individual would expect to see a true treatment effect (Montori, et al., 2004). Most often, a confidence interval of 95% represents the range seen within medical publications (Montori, et al., 2004). Furthermore, narrower CIs result from larger sample sizes investigated within a research study.

Reliability and Validity

Unfortunately, quality cannot be ensured simply because an article is published in a peer-reviewed journal (Williamson, Goldschmidt, & Colton, 1986). Therefore, as part of the critical appraisal process, a clinician must assess both the reliability and validity of the results. Reliability is defined as " the extent to which results are consistent over time and an accurate representation of the total population under study" (Joppe, 2000). Furthermore, reliability also focuses on the reproducibility of the intervention under a similar methodology (Joppe, 2000). If the results of a study are found to have high reliability, than the intervention should be easily reproduced (Golafshani, 2003). However, although reliability of a study may be able to be proven does not necessarily indicate that it is also valid (Golafshani, 2003). Validity "determines whether the research truly measures that which it was intended to measure or how truthful the research results are" (Joppe, 2000). Moreover, do the means of the measurement accurately represent what the author intended them to (Golafshani, 2003)? Overall, to increase the quality and strength of a research publication, the study's measurements should be identified as both reliable and valid.

Intra-Class Correlation Coefficients

There are several reliability coefficients available that allow an investigator to further distinguish the reliability measures of a study. Two of the more commonly seen reliability coefficients are the intra-class correlation and Cohen's Kappa coefficients. The intra-class correlation coefficient (ICC) involves a descriptive ratio that determines the amount of variance between two repeated measures. Distinguishing the reliability of measurements between trials or observers is important in assessing the extent in which a measurement is actually measuring anything at all (Shrout & Fleiss, 1979). If measurements are found unreliable, their use in research analyses will violate numerous statistical assumptions (Shrout & Fleiss, 1979).

There are six different forms of intra-class correlation coefficients; each type is utilized based on the research design and intent of the study. Furthermore, each of the six ICC forms can create significantly different results when applied to a single data set (Shrout & Fleiss, 1979). There are several guidelines a researcher must consider when selecting the appropriate intra-class correlation coefficient type. For example, whether the use of a one-way or two-way analysis of variance (ANOVA) is appropriate for analyzing the data can be considered an important determinant of which ICC form should be selected (Shrout & Fleiss, 1979). Unfortunately, only one or two of the ICC forms are most often discussed in textbooks, therefore making it difficult for researchers to be aware of and fully comprehend the differences between the six classifications (Shrout & Fleiss, 1979).

Generally, the intra-class correlation coefficient is calculated by dividing the variance of interest from the sum of the variance of interest plus error (Bartko, 1976). An ICC below 0.5 is considered a poor reliability measure, whereas an ICC ranging between 0.5 and 0.75 is considered moderate. Finally, an intra-class correlation coefficient calculated to be greater than 0.75 is believed to be a good measure of reliability (Vargha, 1997).

Cohen's Kappa Coefficients

Cohen's Kappa coefficient, also known as the κ statistic, involves reliability measures of observer variability. More specifically, the kappa coefficient corrects for inter-rater agreement beyond chance (McGinn, et al., 2004). By utilizing Cohen's kappa, an investigator is able to assess the amount of agreement that occurred between two raters beyond the expected value of chance alone. Without considering the possibility of agreement due to chance, clinicians may attempt to reproduce clinical tests with unrepresentative conclusions (McGinn, et al., 2004). Generally, kappa scores range from 0, indicating no agreement beyond chance, to 1, which is considered 'almost perfect' (McGinn, et al., 2004). For example, a study conducted by McCombe et. al. calculated a κ statistic of 0.82 for the straight leg test, revealing a substantial degree of agreement beyond chance in regards to reproducing signs and symptoms of low-back pain (McCombe, Fairbank, Cockersole, & Pynsent, 1989).

To calculate Cohen's kappa, two numbers are needed. The first number includes the observed agreement, that is, the percentage in which the raters' results coincide with one another. This number is subtracted from 100% to identify the degree of observed agreement beyond chance. The second number required is the maximum agreement expected beyond chance (McGinn, et al., 2004). Once these two numbers are identified, the κ statistic can be determined simply by dividing the maximum agreement beyond chance from the observed agreement chance (McGinn, et al., 2004).

Specificity and Sensitivity

To assess diagnostic accuracy, two common statistical measures are utilized - specificity and sensitivity. Specificity, also known as the *true negative rate*, determines if a test is effective at ruling in a particular disorder or condition (Hegedus, 2009). More specifically, the specificity measure focuses to distinguish the proportion of individuals that do not have a precise diagnosis. Specificity is calculated by dividing the number of true negatives (people who truly do not have the diagnosis) from the sum of true negatives plus false positives (people who were deemed to have the diagnosis when they actually do not) (Hegedus, 2009).

Conversely, sensitivity, also known as the *true positive rate*, distinguishes if a test is effective at ruling out a specific diagnosis (Hegedus, 2009). If a test is considered highly sensitive, it is believed to be successful at identifying the proportion of individuals that do have a particular diagnosis. Sensitivity is calculated by dividing the number of true positives (people who truly have the diagnosis) from the sum of the true positives plus false negatives (people who were considered not to have the diagnosis when they actually do) (Hegedus, 2009).

To help clinicians and researchers remember the differing fundamentals, two phrases are commonly associated with specificity and sensitivity – "SpPIN" and "SnNOUT". Introduced by Sackett et al. in 1992, these mnemonics are frequently taught and utilized as standards by numerous clinicians (Hegedus, 2009). When broken down, SpPIN is translated to discern that when specificity is high, a positive test will rule a diagnosis in. SnNOUT, on the other hand, indicates that when sensitivity is high, a negative test will rule a diagnosis out (Hegedus, 2009). By utilizing these mnemonics as guidelines, clinicians can easily remember the distinguishing features between a highly specific and highly sensitive diagnostic test.

Although used as guidelines to assess the accuracy of a diagnostic test, specificity and sensitivity measures have some limitations. First, as one of these parameters generally tends to rise, the other is likely to fall. Therefore, only having the information for one of the measures for a particular diagnostic test could mislead a clinician of its true effectiveness (Hegedus, 2009). Secondly, the estimates of specificity and sensitivity that are determined in an accuracy study are affected by the number of diagnosed subjects in the study as well as the severity of the diagnosis itself (Bhandari & Guyatt, 2005; Fritz & Wainner, 2001). Furthermore, these estimates are dependent on the prevalence of the disorder or condition, otherwise known as the pre-test probability (Hegedus, 2009). If a condition is rare, it becomes more difficult to conduct an accuracy study to determine the specificity and sensitivity of diagnostic tests to rule the disorder in or out.

Likelihood Ratios

To help improve the inadequacies of specificity and sensitivity, likelihood ratios (LR) are often used to assess the probability of results. By combining specificity and sensitivity, likelihood ratios indicate a shift in probability, and therefore are represented in both the positive and negative form. A positive likelihood ratio (LR+) represents the ratio between the probability of an individual with the diagnosis having a positive test and the probability of an individual without the condition having a positive test. In other words, a LR+ is the resultant of sensitivity divided by 1 minus specificity [LR+ = sensitivity/ (1- specificity)] (Bigby, 1998). A positive likelihood ratio moves a clinician closer to a diagnosis while a negative likelihood ratio moves a clinician further way (Hegedus, 2009). A negative likelihood ratio (LR-) represents the ratio between the probability of an individual with the diagnosis having a negative test and the probability of an individual without the condition having a negative test. In regards to sensitivity and specificity, a negative likelihood ratio is the resultant of 1 minus the sensitivity divided by the specificity [LR- = (1-sensitivity/specificity] (Hegedus, 2009). Likelihood ratios range on a scale of zero to infinity, with a 1.0 signifying probability alterations to a very small degree (Hegedus, 2009).

Predictive Values

For any diagnostic test, it is important to know the probability the test holds in ruling in or out a diagnosis. Along with understanding the specificity, sensitivity, and likelihood ratios of a diagnostic test, predictive values also play an important role. Similarly to likelihood ratios, predictive values also have positive and negative forms. A positive predictive value (PPV) represents the proportion of patients with the diagnosis that have a positive test (Altman & Bland, 1994). A negative predictive value (NPV) on the other hand indicates the proportion of patients without the diagnosis that have a negative test (Altman & Bland, 1994). To calculate predictive values, the prevalence rate of the condition is needed. Therefore, if the prevalence of a disease or condition is low, the PPV will be low as well (Altman & Bland, 1994).

Levels of Evidence

As previously mentioned, the purpose of critical appraisal is to identify the value of the research evidence and determine whether it can be applied to clinical practice. As well as having a clear understanding of the evidence-based concepts discussed in research literature, it is also important to understand the varying levels of evidence. Due to the numerous levels of evidence available, the validity of a study's conclusions must be weighted differently depending on the type of study design utilized (Fineoutoverholt, et al., 2005). Research studies can be designated a grade that determines the strength of the evidence presented for a particular intervention (Fisher & Wood, 2007). Several grading systems, such as the Oxford Centre for Evidence-based Medicine Levels of Evidence scale and the Strength of Recommendation Taxonomy (SORT), have been designed and implemented in attempt to classify the varying levels of evidence and provide grades of recommendation (Fisher & Wood, 2007).

One of the most commonly used methods of grading evidence is the Oxford Centre for Evidence-Based Medicine's levels of evidence and grades of recommendation (Phillips, et al., 2001). This method categorizes evidence based on the quality of the study design as well as the consistency of the results among similar studies (Medina, McKeon, & Hertel, 2006). The Oxford Centre for Evidence-Based Medicine (CEBM) utilizes a five level grading system with level one being of the highest quality and level five being the lowest. The lowest level of the CEBM scale consists of research information from expert opinion, anecdotal evidence, bench research, animal research and unpublished clinical observations (Medina, et al., 2006). Level four comprises evidence gathered from case reports and series, or from case-control and cohort studies that have been deemed to be of poor quality design. The third level of the CEBM scale is designated for case-control studies. Level 3a is made up of systematic reviews of case-control studies while 3b consists of individual case-control studies (Medina, et al., 2006). The second and first levels of the CEBM scale are divided into three subcategories. Level two encompasses cohort studies. Level 2a is made up of systematic reviews of cohort studies, level 2b categorizes individual cohort studies, and level 2c is designated for outcomes research (Medina, et al., 2006). The final and highest level of evidence in the CEBM scale consists of randomized controlled trials. The first two subcategories of level one are similar to level two where level 1a is for systematic reviews and level 1b is for individual studies. However, the 1c level of this grading system is made up of all-or-none studies (Medina, et al., 2006). Each type of research study found during a literature search can be classified in one of the CEBM levels of evidence, and therefore can guide the clinician in determining the value of the reported results (Medina, et al., 2006).

The CEBM has also developed a systematic grading scale, which grades and recommends the amount of confidence for the evidence to be utilized throughout clinical practice (Medina, et al., 2006). Similar to an academic grade, the research evidence can be given a grade ranging from A to D that distinguishes how well the information can relate to interventions through practice (Phillips, et al., 2001). When evidence receives a grade A, the information can strongly be argued for or against a particular intervention as it usually comes from a level one well-designed randomized controlled trial (Medina, et al., 2006). As the grade decreases, so does the level of confidence given to the evidence in question. A grade B recommendation denotes research evidence from the CEBM levels two or three whereas a C grade is associated with level four evidence (Medina, et al., 2006). Finally, a grade of D, also depicted as I for insufficient, concludes that the available research is inadequate to make a sound clinical recommendation (Medina, et al., 2006).

Critical Appraisal Tools

Due to the demanding schedule of most health care clinicians, it is difficult to delegate time to explore current research. Therefore, the use of critical appraisal tools can be helpful in providing shortcuts to accessible and useable research. One such instrument that is gaining popularity among allied health care professionals are critically appraised papers. A Critically Appraised Paper (CAP) is a one-page analysis of an article published in a peer-reviewed medical journal. The CAP format is typically standardized to include a PICO-formulated clinical question as well as a clinical bottom line. The clinical bottom line identifies the author's recommendations for clinical application based on the significant results of the study. Additionally, a CAP also includes a summary of the methods, results, and validity of the study (C. Welch, et al., 2008).

Another instrument that helps to reduce the critical appraisal time for the clinician is a critically appraised topic. A Critically Appraised Topic, otherwise known as a CAT, is similar to a CAP. However, although both the CAP and CAT are parallel instruments for the critical appraisal of research evidence, there are a few distinguishing factors. First, whereas a critically appraised paper analyzes only one individual research study, a critically appraised topic is a synthesis of numerous studies (no fewer than three) reviewing the same general topic of interest (Wingerchuk & Demaerschalk, 2007). CATs also typically include tables and charts that identify specific information from each study being critically appraised. Finally, unlike critically appraised papers, the clinical bottom line of a CAT should be more definitive since conclusions are drawn from multiple studies rather than only one (C. Welch, et al., 2008).

By reviewing a critically appraised paper, a practitioner is able to quickly determine whether the results of a detailed study are applicable to the clinical question. If the CAP or CAT is applicable to a specific case, the clinician is able to easily, efficiently, and safely reproduce the intervention described by the research and predict the prognosis of the intervention for the patient in practice. Several other instruments, such as clinical prediction rules, are also available to provide clinicians with quick access to manageable research. Furthermore, computerized programs including CATMaker and EBM Calculators, exist to provide clinicians with a step-by-step approach of critically appraising research studies.

Step Four – Applying the Evidence

The fourth step of evidence-based practice entails applying the research evidence to clinical practice. Once the clinical question has been formulated, properly investigated through a literature review, and then critically appraised for its quality and validity, it can now be applied to the specific patient problem or population in question. It is important to note with this step however, that the clinician should not be forced to provide a certain treatment or act in a particular way that they are uncomfortable with (Steves & Hootman, 2004). To reiterate the message again, evidence-based research merely provides another tool, alongside patient preference and clinical expertise that a clinician can utilize on a day-to-day basis.

Step Five – Evaluating the Outcomes

The last step of the evidence-based practice progression involves evaluating the outcomes of the particular patient or population. More specifically, did the PICO formulated question, literature search, thorough critical appraisal and application of the best evidence achieve the appropriate outcomes and benefit both the clinician and the setting in which it was being utilized. For successful evidence implementation into a clinical setting, it is important for clinicians to consider appropriate outcomes (Fineoutoverholt, et al., 2005). When evaluating such outcomes, the clinician must remember that EBP principles focus on improved patient care through a collaboration of best practices (Fineoutoverholt, et al., 2005).

Clinician Barriers towards Evidence-Based Practice

The term evidence-based practice is vastly spanning across medical and allied health professions, however many clinicians are timid about its particular applications to health care. Some clinicians believe that evidence-based practice will only advocate cookbook health care that will focus exclusively on treating patients according to a formula or algorithm and not on an individual basis (Haynes, 2002). Another assumption about EBP is that clinicians whose practice is based on applied health care from evidence research provide superior patient care when compared to those practitioners who solely practice traditional health care. However, no direct evidence indicates that this supposition is correct (Haynes, 2002). Nevertheless, clinical decisions should be made from a combination of the best research evidence, clinical circumstances, and patient requests (Haynes, 2002). As evidence-based practice transforms to become the foundation of health care, it is important for all allied health professions to accept and implement this fundamental idea into clinical practice and education.

Teaching Evidence-Based Practice in Athletic Training

With the rapid evolvement of evidence-based practice throughout the allied health care professions, it is evident that for EBP clinical practice to prosper and strengthen in the future generations of health care, effective strategies to teach evidence-based practice must be implemented into educational curricula as early as the undergraduate freshman year. To date, many allied health care undergraduate and graduate programs have already begun the implementation process; however, there has been very little to no evaluation of the skills taught and whether the students are taking what is learned in the classroom and applying it to their clinical practices (Ciliska, 2006). Therefore, without any form of evaluation, it is difficult to know if the evidence-based practice that is currently being implemented into the didactic curricula of numerous educational programs is producing effective results or whether changes need to be made in the future.

EBP in Other Allied Health Professions

Before the current status of evidence-based practice implementation in the athletic training profession can be discussed, it is important to have an appreciation of where other allied health care professions stand. Even though evidence-based practice is integrating its way into all allied health care occupations, each profession is currently at a different place in developing and implementing EBP concepts into their discipline (Kronenfeld, et al., 2007). The nursing profession for example, has modeled EBP into clinical practice as well as nursing education over the past decade. Accrediting bodies, governing agencies, health care payers and the increase of malpractice litigations are only a few of the several influences for the push towards EBP in the nursing profession (Zinberg, 1997). Although opponents argue that there is no direct evidence implicating that evidence-based practice makes a difference in healthcare, there have been several reviews in nursing research indicating otherwise (Ciliska, 2006). Heater et al. (1988) illustrated that considerable gains were observed in patients' physiological, psychological and behavioral outcomes when compared to patients who were treated with routine nursing care (Heater, Becker, & Olson, 1988). However, Banning (2005) concluded that nurses have difficulty making the distinction between evidence-based practice and a regular research process and therefore believed that the two were the same thing (Banning, 2005). While future research is needed to determine the true effectiveness of evidence-based practice in health care, the profession of nursing has become the frontrunner of evidence-based clinical practice among allied health care professions.

Even though EBP is still a relatively new concept in nursing, it has not only flourished throughout the profession but has also begun to refocus the curricula of both undergraduate and graduate nursing educational programs. *Evidence-Based Nursing*, a journal containing research articles relevant to nurses was established in 1998 (Ciliska, 2006). Alongside each article in this journal is a commentary discussing the clinical application of the research findings in regards to nursing clinical practice. Another journal focusing on evidence-based practice, *Worldviews on Evidence-Based Nursing*, began publication in 2004 and focuses on research utilization in clinical nursing practice. Thirdly, at least five evidence-based practice textbooks have been published and implemented within nursing over the past several years. Sales and revenues of such textbooks have indicated a high level of interest for the topic (Ciliska, 2006).

One of the biggest issues of evidence-based practice within nursing curricula to date is improper implementation. In some undergraduate nursing education programs, evidence-based practice research is being taught throughout nursing courses, however educators are not instructing students on how to ask, find, critique and apply the actual evidence to their own clinical practice (Ciliska, 2006). Conversely, other programs may be teaching their students the four fundamental steps to evidence-based practice without recognizing this approach. Throughout the Master's degree level, nursing students often graduate with the knowledge of how to design and conduct studies but not necessarily understand the proper ways to critique and utilize current research evidence (Ciliska, 2006).

Another issue that affects the implementation of evidence-based nursing education is the awareness of EBP at the educator level. Evidence-based practice cannot successfully be incorporated in nursing education unless the faculty and staff fully understand the concept themselves. This may require professors to tread in uneasy waters to adjust their current teaching styles as well as participate in more continuing education opportunities that will allow them to determine how to overcome these barriers (Ciliska, 2006). It is necessary to make sure education faculty and staff are on board with evidence-based practice before successfully integrating EBP into nursing education. In the future, application of evidence-based research into clinical practice as well as critical appraisal skills may need to be incorporated into job descriptions and postings to ensure faculty and staff preparedness for implementation of EBP into the program's curriculum (Ciliska, 2006). Thus, while there are a few dilemmas that affect the execution of evidence-based practice into nursing educational curriculum, to date the nursing profession is the most advanced of the allied healthcare professions in regards to teaching students how to utilize the EBP process within clinical practice.

EBP in Athletic Training

Due to the lack of clinically relevant evidence available for the athletic training profession, the National Athletic Trainers' Association Research & Education Foundation (NATAREF) has requested proposals for applicable clinical research as well as increased the amount of funds available for prospering research investigators over the past seven years (Steves & Hootman, 2004). By doing so, the NATAREF hopes to support aspiring researchers to produce outcomes that can be applied to clinical practice as well as aid in the advancement of the profession. While the majority of allied health peer-reviewed journals have been distributing numerous research studies for decades, research published in athletic training journals has only recently begun to become more substantial. Prior to

2002, the majority of athletic training publications solely included narratives, editorials, and subjective summations (Steves & Hootman, 2004). Furthermore, in a study investigating the literature of athletic training, Delwiche & Hall revealed that the AT profession relied heavily on the research literature from closely related professions due to the insufficient amount of clinical research currently published specifically for athletic training (Delwiche & Hall, 2007). Thus, it has been discussed that well-designed randomized controlled trials and systematic reviews based off of randomized controlled trials will provide the strongest outcomes to be applied to clinical practice (Bleakley, 2002), and therefore need to be conducted for athletic training research to prosper in the future years.

To date, very little to no research has been conducted in regards to evidence-based practice and athletic training. Several articles exist identifying the importance and need for EBP within the profession, as well as recommendations for potential ways to implement evidence-based concepts into athletic training curricula (Fineoutoverholt, et al., 2005). However, the infiltration of evidence-based practice within athletic training is currently still in the initial stages (Kronenfeld, et al., 2007). Before evidence-based concepts can make their way into athletic training didactic curricula, program directors, educators, and clinicians not only need to be comfortable with particular aspects of EBP, but also must recognize and appreciate its importance for implementation.

Implications for Implementation

Several implications emphasize why the implementation of evidence-based practice is necessary. To begin, increasing access to computers and the internet will provide clinicians with the physical means to search for answers to their evidence-based questions. Internet access also allows the most current research to be available worldwide as well as promotes global sharing of clinical results and expertise (Ciliska, 2006).

The main purpose of allied healthcare is to improve patient outcomes. To do so however, evidence from both clinician- and patient-based outcomes (step five of the EBP process) need to be provided. Clinician-based outcomes can be described as outcome measures that assess patient healthcare from the clinician's perspective (A. Snyder, McLeod, & Sauers, 2007). Conversely, patient-based outcomes are typically self-reported outcomes perceived from the patient (A. Snyder, et al., 2007). By acquiring these values, practitioners will be able to identify if particular treatments applied in the clinical setting (step four of the EBP process) were successful. If the outcomes prove to be not beneficial, clinicians will then be able to refer back to the literature retrieved (step two) and reappraise research evidence (step three) for future clinical problems and patient cases. However, without the knowledge or confidence of the EBP process, clinicians will not be able to perform the cycle described above, therefore further neglecting the enhancement of patient healthcare.

Within the curriculum, the need for evidence-based practice implementation is evident. First, learning the EBP process throughout an undergraduate career allows our future clinicians to be prepared with the skills to analyze and interpret the quality of evidence for clinical application. Throughout several athletic training courses, educators rely heavily on textbooks to provide essential information. However, the difficulty with textbooks is staying current (Steves & Hootman, 2004). Since new research is consistently being published, a textbook can be outdated or contradicted even within weeks of its initial release (Heinrichs, 2002; Steves & Hootman, 2004). Secondly, for novice athletic training students, inconsistency between diagnostic skills, judgment, and clinical experience is often large (Heinrichs, 2002). With the implementation of EBP early on however, novice students will hopefully be able to more quickly apply critical thinking to clinical practice scenarios.

Challenges for Implementation

Several challenges restrict educators from accepting evidence-based practice and implementing it throughout every day clinical and didactic education. One such challenge in the EBP learning process is for both educators and clinicians to be able to recognize and admit uncertainties within their practice (Johnston & Fineout-Overholt, 2005). Without being able to identify such uncertainties and potential weaknesses, individuals will never be able to even successfully approach the first step of EBP, let alone implementing it into lesson plans and course outlines.

Next, because evidence is not available for all diagnostic tests, treatments, or patient circumstances, it may leave educators confused as to whether they should be teaching students efficacy or futility (H. G. Welch & Lurie, 2000). More specifically, both educators and students may question whether interventions for clinical practice should be considered worthwhile until proven of no use, or ineffective until proven valuable (H. G. Welch & Lurie, 2000). Without solid answers to these questions, educators may severely restrict their willingness to implement evidence-based practice into their didactic courses. Furthermore, an additional challenge may be to persuade an educator to transition from their habitual teaching styles and strategies potentially practiced for years, towards the new and unfamiliar territory of evidence-based practice implementation (Bilsker, 2004).

The largest challenge for any allied health care educational program is to produce clinicians who are independent and capable of critical thinking and problem solving, and who can identify circumstances in which a critical decision must be made rapidly (Heinrichs, 2002). Program directors and educators must often ask themselves which teaching strategies will be best for individual courses within the curriculum (Heinrichs, 2002). Within athletic training curricula, these educational leaders contemplate teaching techniques that will most effectively and accurately demonstrate a particular competency, which can therefore be carried over to the student's clinical experience.

Teaching Evidence-Based Practice

With the vast evolvement of technology, current knowledge and information has become readily available with the click of a mouse. Therefore, because the millennial student is multimedia-savvy, traditional teaching methods, such as the lecture format, that were once utilized to teach students critical thinking and decision making skills may no longer be appropriate or effective for the students of today (Heinrichs, 2002). Over the past decade, educational instructors have begun to move away from a passive lecture model and shift towards a more practical student-centered teaching strategy (Heinrichs, 2002). This teaching strategy engages the students and encourages them to take a more active role in the learning process. Active learning, therefore, has been defined as "environments that allow students to talk and listen, read, write, and reflect as they approach course content through problem-solving exercises, informal small groups, simulations, case studies, role playing, and other activities - all of which require students to apply what they are learning" (Heinrichs, 2002). Case studies in particular are a fantastic way in which an individual can learn a large scope of knowledge from a single given scenario, and therefore should be highly emphasized throughout a student's educational career (Heinrichs, 2002). Active teaching tactics, such as the utilization of case studies, have been incorporated for more than sixty years and it has been observed that students are more likely to become active classroom participants when a real-life scenario or problem that relates to their field of study is being discussed (Heinrichs, 2002). Active learning also provides the opportunity for students to verbalize their thought processes and provide justifiable rationales behind their decision-making as well as recognize other potential solutions gained from the insight of their peers (Heinrichs, 2002).

Problem-based learning (PBL) is one of the most commonly used teaching techniques among allied health educational programs. PBL teaches students how to think critically and engages them to recognize, attack, and solve problems that they may encounter both clinically and in everyday life (Heinrichs, 2002). It is an active-learning technique that focuses on presenting problems to students, which directs them to use educational tools to hypothesize possible solutions, research pertinent data related to the problem, apply self-directed study and/or group communication, and ultimately develop a conclusive resolution to the initial issue (Heinrichs, 2002). Problem-based learning therefore teaches the student how to utilize the most available resources, communicate with others and in some instances work as a team to efficiently solve the problem at hand (Heinrichs, 2002).

Problem-based learning is an important concept that should be highly emphasized in athletic training educational curriculum. Although problem-based learning may seem like a long and tedious process to give students information that is essential to their field of study, it allows individuals to develop the skills that will enable them to sort through abundant amounts of information, decipher which facts are appropriate and confidently attain conclusive answers. PBL will also stretch the boundaries of the student's intellect to reach a conclusion concerning an issue in which they have not learnt any prior knowledge. By doing so, the student will learn how to think critically as well as become a lifelong learner; something that may not be achieved in a traditional lecture-based classroom setting. Especially in the field of athletic training, problem-based learning will prepare entry-level and graduate students for situations in which they may come across as a certified athletic trainer. (Heinrichs, 2002).

It is important to note that problem-based learning scenarios and experiences must be formulated in such a way that the student can fluently transfer the knowledge gained in the classroom to more critical and unanticipated real-life problems encountered in the clinical setting (Heinrichs, 2002). However, if the PBL technique is used correctly, it will afford numerous advantages to the student. To begin, students tend to become more engaging and enthusiastic learners when a problem-based learning strategy it utilized in the classroom. PBL scenarios can be found more enjoyable for both the students as well as the educational instructor as they allow for exploration, creativity, discussion, debate, and identification of more open-minded approaches to solving a given problem (Saarinen-Rahiika & Binkley, 1998). It has also been found that information discussed is better received, retained and utilized during their clinical experience when PBL is incorporated in the didactic curriculum (Saarinen-Rahiika & Binkley, 1998).

By utilizing active learning techniques such as problem-based learning, educators are already preparing students to think critically and analyze patient cases. The incorporation of evidence-based practice along with problem-based learning should prove to be an easy process as they share numerous features. Both concepts identify the area of uncertainty, formulate clinical questions, assess the clinical relevance of research evidence, assess the clinical application as it applies to the area of uncertainty, and finally measure the outcomes of the clinical treatment (Heinrichs, 2002). However, before focus can be shifted to the implementation of evidence-based practice into didactic curriculum, methods of efficiently educating the individuals responsible for a student's education must be solidified.

EBP Workshops & Courses

Throughout the past several years, numerous "evidence-based"-related workshops and courses have been conducted in anticipation of enlightening both students and educators. Unfortunately, many of today's health care educators lack the quality of skills for attainment, appraisal, and application of research evidence into clinical practice (Nicholson, Warde, & Boker, 2007). Before such skills can be required of allied health students, it is necessary for educators to master the knowledge of these tasks and gain comfort so that they may begin implementation into the curriculum as well as their own clinical practice. A study conducted by Houston et al in 2004 revealed that almost half (46%) of clinicians desired more guidance and instruction in evidence-based practice (Houston, Ferenchick, Clark, & Bowen, 2004).

Several studies have illustrated that "evidence-based"-related workshops and short courses have indeed proven to be successful in increasing educators' knowledge and comfort of EBP. In 2007, Nicholson et al revealed that a 90-minute workshop occurring every 4-6 weeks for a 1-year period significantly improved clinical educators literature retrieval and critical appraisal skills (Nicholson, et al., 2007). In 2002, Fritsche et al concluded that an intensive 3-day evidence-based medicine course increased postgraduate doctors' evidence-based knowledge and skills by 57% (Fritsche, 2002). Thirdly, by providing seven 1-hour evidence-based training courses focusing on literature searching and critical appraisal, Straus et al revealed that attending physicians were significantly more likely to base patient interventions on high-quality research after completing the courses (Straus, Ball, Balcombe, Sheldon, & Mcalister, 2005).

In regards to attitudes and beliefs, several clinicians have expressed concerns that although evidence-based practice seems important, their lack of research training would significant affect their abilities to clinically practice utilizing an evidence-based approach. A study conducted by Stevenson et al in 2004 revealed that prior to an intervention training, clinicians agree that evidence-based practice is important, albeit were generally reluctant to changes their current practices. However, six months after completing an interactive evidence-based educational program, clinicians reported higher confidence levels in their abilities to conduct literature searches as well as critically appraise research (Stevenson, Lewis, & Hay, 2004).

Particularly in athletic training, the majority of "evidence-based"-related workshops solely focus on identifying what evidence-based practice is, the implications and challenges of EBP, and why its implementation is important for the advancement of the profession. However, more courses need to be made available on how to assess the patient, ask the appropriate clinical question, acquire the best evidence for the case, appraise the results, and finally to apply it to the patient or population if appropriate (Nicholson, et al., 2007). Thus, since the majority of practicing clinicians rely on courses and in-service training sessions to keep up-to-date with current information, it is important that "evidence-based"-related workshops continue to be made available. More specifically, such courses and workshops should continuously aim to enhance the knowledge and skills of allied health care professionals, particularly in the areas of acquisition and appraisal of research evidence.

Questionnaires

Along with a multitude of workshops exclusively on evidence-based practice, numerous survey instruments and questionnaires have recently been developed to assess the knowledge and perception levels of various allied healthcare clinicians. The use of questionnaires provide an advantageous method of obtaining information from psychological factors such as attitudes, beliefs, behaviors, motivations, and fears, as well as important demographic information (Portney & Watkins, 2000; Turocy, 2002). However, investigators utilizing questionnaires must be aware that disadvantages include the possibilities for misinterpreting questions or response choices as well as the known limitation of the self-reporting system (Portney & Watkins, 2000). Furthermore, it is important to note that the typical response rate for web-based surveys and questionnaires via e-mail is only 36.83% (Sheehan, 2001).

Unfortunately, a majority of the evidence-based practice questionnaires available have not been validated and therefore have weakened the conclusions gained from research studies (Smith, et al., 2000). Furthermore, a greater portion of the EBP survey instruments designed focus to exclusively evaluate a particular evidence-based curriculum developed (Shaneyfelt, et al., 2006). Therefore, most of these survey assessments lack the exactitude of examining psychological factors effecting evidence-based practice as well as deciphering appropriate educational interventions for EBP implementation (Shaneyfelt, et al., 2006).

Two particular instruments that have been validated are the *Fresno Test of Evidence Based Medicine* and the *Berlin Questionnaire*. Although developed to distinguish the effectiveness of an evidence-based curriculum in the University of California, San Francisco's Fresno family practice residency program, the *Fresno Test of Evidence Based Medicine* has frequently been adopted by other allied health investigators seeking similar findings. This instrument was designed to involve short answers based off of clinical scenarios, therefore requiring the participant to demonstrate knowledge of applying the steps of the evidence-based practice process (Ramos, 2003). The *Berlin Questionnaire* on the other hand, was developed to assess physicians' knowledge in regards to interpreting research evidence as well as the ability to utilize quantitative information to resolve patient problems (Fritsche, 2002). Similarly to the *Fresno Test of Evidence Based Medicine*, the *Berlin Questionnaire* has also been adopted by other investigators in the creation of new evidence-based practice questionnaires.

As previously mentioned, several EBP questionnaires focus to identify the attitudes and perceptions of allied healthcare professionals. In 2003, Jette et al utilized a self-reported questionnaire for physical therapists that was designed based off of a previous questionnaire to assess general practitioners' perceptions of EBP (Jette, et al., 2003; McColl, Smith, White, & Field, 1998). The questionnaire not only assessed physical therapists' attitudes towards evidence-based practice, but also investigated their motivations and perceived barriers to engage in EBP. Interestingly, 90% of the respondents indicated that evidence-based practice was necessary; however, 67% rated insufficient time as one of the main barriers to implementing EBP into their clinical practice (Jette, et al., 2003). In another study, Yousefi-Nooraie et al utilized a questionnaire to assess educators' importance levels for various topics within evidence-based practice courses (Yousefi-Nooraie, Rashidian, Keating, & Schonstein, 2007). The investigation revealed that educators' agreed that the basics of EBP, question formation, literature retrieval, and critical appraisal are considered introductory concepts and should primarily be discussed in preliminary courses and workshops, while more in-depth statistical concepts should be focused on in advance-level courses (Yousefi-Nooraie, et al., 2007). Furthermore, particular topics should be avoided and/or less stressed in novice evidence-based practice workshops and courses.

To date, there are very few, if not any, questionnaires or surveys that exclusively focus on the psychological factors of athletic training educators in regards to the implementation of evidence-based practice. To accurately collect and assess such variables, a valid instrument must be created and distributed to the athletic training education population.

CHAPTER III

METHODOLOGY

This study utilized a quasi-experimental approach to assess knowledge, comfort, and importance levels of athletic training educators registered for the 2009 Athletic Training Educators' Conference through a survey assessment. Additionally, registrants of the pre-conference workshop entitled, *Evidence-Based Concepts for Clinical Practice Education: A Study Investigating the Effectiveness of a Single-Day Workshop* were utilized as a small pilot group to determine the effectiveness of a single-day workshop. All subjects were asked to complete the *Evidence-Based Concepts for Clinical Practice Assessment* and Demographics Questionnaire prior to the 2009 Athletic Training Educators' Conference. Furthermore, participants of the pre-conference workshop were asked to complete the *Evidence-Based Concepts for Clinical Practice Assessment* again following the conference. The independent variables were the subjects' characteristics as determined by the demographics questionnaire as well as time (pre and post). The dependent variables consisted of the scores produced on the survey for each of the three components (knowledge, comfort, and importance).

Subject Characteristics

All registrants of the 2009 Athletic Training Educators' Conference (N=498) were solicited for participation in this study. One hundred forty-one individuals responded to the pre-conference assessment for a response rate of 28.3%. Subjects consisted of 62 male (41.32 ± 8.92) and 79 female (36.08 ± 7.91) athletic training educators. Subjects had an average of 9.81 ± 7.19 years of athletic training teaching experience. The frequency information most relevant to this analysis for the subject group is presented in Table 1. The College Human Subjects Committee approved this study and consent was implied upon voluntary submission of the completed survey.

All attendees of the evidence-based concepts pre-conference workshop (N=23) were again solicited for participation in a follow-up assessment. Sixteen individuals responded to the post-workshop for a response rate of 69.6%. Only ten individuals could accurately be matched to pre-conference demographics, therefore six individuals were excluded from the pre-post workshop assessment. Subjects consisted of 6 male (47.83 ± 4.71) and 4 female (33.50 ± 10.02) athletic training educators. Subjects had an average of 13.25 ± 9.36 years of athletic training teaching experience.

Instrumentation

Currently there are two survey instruments that have been utilized for the assessment of clinicians' evidence-based practice knowledge levels. The *Fresno Test of Evidence-Based Medicine* and the *Berlin Questionnaire* have both been found to be reliable and valid. However, due to the population being assessed as well as the manner of questions and level of knowledge required to successfully complete these surveys, they were deemed unsuitable for use in this research study.

Due to the lack of an appropriate pre-existing instrument to assess evidence-based practice knowledge, comfort, and importance levels of athletic training educators, the research team created an online survey utilizing Inquisite 8.0 Corporate Survey Builder (Catapult System Corporation, Austin, TX). The *Evidence-Based Concepts for Clinical*

Practice Assessment (Appendix A) included three subsections (knowledge, comfort, and importance). The knowledge section consisted of 20 multiple-choice questions evaluating eleven different evidence-based practice concepts (definition of EBP, steps of EBP, reliability, validity, intra-class correlation coefficient, kappa coefficient, specificity, sensitivity, likelihood ratio, positive predictive value, and negative predictive value). These questions were developed from information and recommendations available in the current literature as well as survey instruments utilized in other health care professions. With permission, some of the knowledge questions were adopted from the *Berlin Questionnaire* and modified to apply to athletic training. Each question had one correct response and the participants' composite score in this subsection was calculated by awarding one point for the correct response and zero points for an incorrect response. Therefore, a higher knowledge composite score indicated a higher level of knowledge pertaining to the eleven evidence-based practice concepts. Multiple-choice questions in the knowledge subsection were further broken down into 9 basic-level questions and 11 advance-level questions. Finally, the 20 multiple-choice questions were also grouped into five smaller sections containing 3-5 questions each. Each group consisted of 2-3 of the evidence-based practice concepts as they related to one another. The first subsection [EBPC] focused on the general evidence-based practice concepts including knowledge pertaining to the steps of EBP, levels of evidence, and gold standards for research study designs. The second subsection [RV] included questions about interpreting reliability and validity, while subsection three [RC] involved reliability coefficients such as intra-class correlation coefficients and kappa coefficients. The fourth subsection [SSL] concentrated on sensitivity, specificity, and the interpretation of likelihood ratios. Finally, the last subsection [PV] entailed questions pertaining to positive and negative predictive values. A visual representation of the instrument breakdown can be found in Appendix B. Totaled scores in each section as well as the composite knowledge score were further normalized to percentages.

The comfort section consisted of 11 likert scale questions concerning the eleven evidence-based practice concepts. The comfort level questions inquired whether the participant was comfortable with their ability to implement each of the eleven concepts within diagnostic assessment coursework. The participant had four ordered choices where a score of "1" indicated the participant was very comfortable while a score of "4" indicated the participant was very uncomfortable. During the statistical analysis, the researcher reversed the scale and therefore reconverted each response so that a score of "1" indicated the participant was very uncomfortable and a score of "4" indicated the participant was very comfortable. Therefore, a higher comfort composite score indicated a higher level of comfort pertaining to the eleven evidence-based practice concepts. To coincide with the knowledge subsection, the comfort level questions were broken down into the same basic vs. advance groups as well as the five smaller subsections. The evidence-based practice concepts in each of the comfort subgroups were matched to those included in the knowledge subgroups. Totaled scores in each comfort section as well as the composite comfort score were averaged and therefore normalized to the comfort likert scale.

The importance section also consisted of 11 likert scale questions concerning the evidence-based practice concepts. The importance level questions inquired how important the participant believed each of the eleven evidence-based practice concepts were for implementation within diagnostic assessment coursework. To match the comfort likert scale, the participant again had four ordered choices where a score of "1" indicated the participant believed the concept was very important and a score of "4" indicated the participant believed it was very unimportant. This scale was also reversed during statistical analysis and each response was reconverted to match the comfort scores. Furthermore, the importance level questions were also broken down into the basic vs. advance groups as well as the five smaller subsections and each group was matched for the evidence-based practice concepts as previously described. Totaled scores in each importance section as well as the composite importance score were averaged and therefore normalized to the importance likert scale.

Along with the *Evidence-Based Concepts for Clinical Practice Assessment*, participants were also asked to complete a demographics questionnaire (Appendix C). This questionnaire consisted of 34 questions requesting information related to gender, age, ethnicity, academic work, clinical practice, and research as well as information pertaining to the athletic training education program they were associated with.

Percent agreement was determined via pilot testing with a group of athletic training educators unable to attend the 2009 Athletic Training Educators' Conference. The percent agreement for all questions included on the final instrument averaged at 76.67% with a range from 50% to 100%. All values are displayed in Table 2. Three out of the twenty knowledge questions had a percent agreement of 50%. However, this percentage does not reflect the number of correct responses. For example, only one individual chose the correct answer during both trials of question 10. The remaining individuals chose incorrect answers during the two trials. 40% of these individuals chose the same incorrect answer in each trial. The other 60% however, chose different incorrect answers for the two separate trials, indicating a lack of knowledge for the given question. Thus, in regards to a correct response, the percent agreement for this particular question would be 100%. Values for question 10 are presented in Table 3. Data for the two-trial instrumentation pilot test is presented in Appendix D.

Testing Procedure

A list of the names and contact information of all the registrants for the 2009 Athletic Training Educators' Conference was obtained from the administrative staff associated with the Educators' Conference. These individuals were sent a letter via email requesting participation in the research investigation (Appendix E). The letter contained a description of the overall purpose and importance of the research study, the estimated time to complete the survey, the URL hyperlink directing them to the survey webpage, and a request for their participation. The email also provided contact information for the researcher for comments or questions that concerned either the research study or the survey instrument.

Once the participant completed the survey (indicated by clicking "submit"), the information was automatically sent to the University database system. Individual responses to specified questions were generated in Statistical Package for Social Sciences (version 16.0, SPSS Inc. Chicago, IL) and then matched with a file coding system to maintain participant confidentiality. At the cessation of the survey, participants were asked if they would like to be notified of the survey results as well as the opportunity to enter a drawing for a chance to win one of ten $10 Visa gift cards. Data collection occurred over a three-week period prior to the 2009 conference. Follow-up emails were sent to the participants once every week to thank those who had completed the survey instrument while simultaneously reminding those who had not yet had a chance to respond.

The pre-conference pilot workshop titled, *Evidence-Based Concepts for Clinical Practice Education: A Study Investigating the Effectiveness of a Single-Day Workshop*, consisted of three independent presentations totaling five hours. The primary presentation provided material directly related to the survey instrument (Appendix F), while the other two sessions offered additional EBP implementation information. During the workshop, contact information was collected from all attendees. Two weeks later, each attendee received a letter via email requesting their participation in a post-workshop assessment (Appendix G). Along with a description of the purpose and importance of the post-workshop assessment, the letter also contained a URL hyperlink directing them to a new survey webpage. Data collection occurred over a three-week period. Email reminders were sent approximately every week asking the subjects to complete the survey, and to say thank you to those who already filled the survey out.

Data Analysis

Statistical Package for Social Sciences (version 16.0, SPSS Inc. Chicago, IL) for Macintosh was used to calculate the statistical components. Descriptive statistics were used to calculate the means, standard deviations, and frequencies, as well as to inspect the normalcy of the data. Independent and paired T-tests, one-way ANOVAs, repeated-measures ANOVAs, Mann-Whitney U tests, and Wilcoxon Signed-Rank tests were used to detect differences between groups in regards to terminal degree, hours per week spent of research, evidence-based practice-related workshops previously attended, hours per week spent on academic coursework, and hours per week spent on patient care. Pearson's correlation coefficients (r) were used to determine any correlation between knowledge levels and years of athletic training teaching experience, while Spearman's rank correlation coefficients (ρ) were used to determine any correlation between comfort or importance levels and years of athletic training teaching experience. A detailed breakdown of the statistical tests utilized as they relate to the independent and dependent variables can be found in Appendix H.

Table 1. Frequency Information for All Subjects

Demographic		***Frequency (out of 141)***
Gender	Male	62
	Female	79
Terminal Degree	Have	66
	Do Not Have	75
Hours of Research	Less Than 5	73
	More Than 5	68
"Evidence-Based"- Related Workshops	Have Attended	64
	Have Not Attended	77
Hours of Academic Coursework	Less Than 40	60
	More Than 40	81
Hours of Patient Care	0	72
	>0	69

Table 2. Percentage Agreement of Knowledge Questions

Question	Percent Agreement
1	100%
2	83.33%
3	100%
4	100%
5	83.33%
6	83.33%
7	100%
8	83.33%
9	66.67%
10	50%
11	50%
12	66.67%
13	66.67%
14	83.33%
15	66.67%
16	83.33%
17	83.33%
18	66.67%
19	66.67%
20	50%

Table 3. Percentage Agreement Example

Question 10*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	2	4
2	4	3
3	2	2
4	4	3
5	4	4
6	1	1

* The correct answer for question 10 is 1.

CHAPTER IV

RESULTS

Results

Dependent measures analyzed were the composite percent/scores, basic-knowledge and advance-knowledge percent/scores, and the five individual subsection percent/scores for knowledge, comfort, and importance. Pre-workshop knowledge, comfort, and importance scores were also compared against post-workshop scores to determine the effectiveness of a single-day evidence-based concepts pilot workshop.

A total of 141 subjects were analyzed. The mean percent for the knowledge section was 64.90% ± 13.29 with a range between 30.00% and 90.00% The mean score for the comfort section was 2.44 ± 0.66 with a range between 1.00 and 4.00 The mean score for the importance section was 3.36 ± 0.48, also with a range between 1.00 and 4.00.

Terminal Degree

Knowledge

There was a significant difference for composite knowledge percent ($F(1,139) = 23.96, p < .001$) in regards to terminal degree. Individuals with a terminal degree ($M = 69.92$, $SD = 10.36$) scored significantly higher percentages than individuals without a terminal degree ($M = 59.60$, $SD = 14.11$).

There was a significant main effect for knowledge percent ($F(1,139) = 113.58, p < .001$) for basic and advance-knowledge sections. Individuals performed significantly higher in the basic-knowledge section ($M = 73.84$, $SD = 16.08$) than in the advance-knowledge section (M = 56.74, SD = 10.36). There was no significant interaction between terminal degree and knowledge percent for basic and advance-knowledge sections ($F(1,139) = 0.20, p = .888$). The basic and advance knowledge percentage means and standard deviations for terminal degree are presented in Table 4.

There was a significant main effect for knowledge percent ($F(3.59, 139) = 26.45$, $p < .001$) for the individual five knowledge subsections. Pairwise comparisons showed that the knowledge percentages for the EBPC were significantly higher (M = 72.06, SD = 20.82) than the percentages in RC (M = 61.47, SD = 25.29), SSL (M = 53.62, SD = 21.16), and PV (M = 57.21, SD = 27.12). They also showed that knowledge percentages for RV were significantly higher (M = 76.06, SD = 24.44) than the percentages in RC, SSL, and PV. Significantly higher percentages were also found in RC when compared to SSL and PV. Finally, pairwise comparisons also showed that the SSL subsection had significantly higher percentages than in PV subsection. There was no significant interaction between terminal degree and knowledge percent for the knowledge subsections ($F(3.59, 139) = 0.731, p = .557$). The subsection knowledge percentage means and standard deviations for terminal degree are presented in Table 4.

Comfort

Individuals with a terminal degree (M =2.51, SD = 0.67) had significantly higher composite comfort scores ($z = -2.381, p = .017$) than individuals without a terminal degree (M = 2.27, SD = 0.61).

There were no statistically significant differences for comfort in the basic-knowledge section between those with a terminal degree and those without a terminal degree ($z = -0.967, p = .334$). However, individuals with a terminal degree had significantly higher comfort scores in the advance-knowledge section (z = -2.724, p = .006). The comfort means and standard deviations for the basic and advance knowledge sections are presented in Table 5.

There were no statistically significant differences for comfort found in the EBPC subsection (z = -1.551, p = .121) between those with a terminal degree and those without a terminal degree. There were also no statistically significant differences for comfort found in RV (z = -0.126, p = .900) or in the PV subsection (z = -1.854, p = .064). Individuals with a terminal degree had statistically significant higher percentages in both the RC subsection (z = -3.113, p = .002) and SSL subsection (z = -1.982, p = .047). The comfort means and standard deviations for the knowledge subsections are presented in Table 5.

Importance

There was not a statistically significant difference between individuals with a terminal degree (M = 3.39, SD = 0.46) and individuals without a terminal degree (M = 3.29, SD = 0.50) in regards to composite importance scores (z = -0.897, p = .370).

Statistically significant differences were not found in both the basic-knowledge section (z = -1.464, p = .143) and advance-knowledge section (z = - 1.165, p = .244) in regards to terminal degree. The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 6.

There were no statistically significant differences for importance found in any of the knowledge subsections (z_{EBPC} = -1.631, p_{EBPC} = .103), (z_{RV} = -1.025, p_{RV} = .306), (z_{RC} = -0.850, p_{RC} = .395), (z_{SSL} = -1.225, p_{SSL} = .221), (z_{PV} = -0.865, p_{PV} = .387). The importance means and standard deviations for the knowledge subsections are presented in Table 6.

Hours Per Week of Research

Knowledge

There was a significant difference for composite knowledge percent ($F(1,139) = 4.87, p = .029$) in regards to hours of research conducted per week. Individuals who conduct more than five hours of research per week ($M = 66.96$, $SD = 12.61$) had significantly higher percentages than individuals who do not ($M = 62.01$, $SD = 13.93$).

There was a significant main effect for knowledge percent ($F(1,139) = 114.01$, $p < .001$) for basic and advance-knowledge sections. Individuals had significantly higher percentages in the basic-knowledge section ($M = 73.84$, $SD = 16.91$) than in the advance-knowledge section ($M = 56.74$, $SD = 16.08$). There was no significant interaction between hours of research conducted per week and knowledge percent for basic and advance-knowledge sections ($F(1,139) = 0.103, p = .749$). The basic and advance knowledge percentage means and standard deviations for hours of research conducted per week are presented in Table 7.

There was a significant main effect for knowledge percent ($F(3.59, 139) = 26.59$, $p < .001$) for the individual five knowledge subsections. Pairwise comparisons showed that the knowledge percentages for the EBPC were significantly higher ($M = 72.06$, $SD = 20.82$) than the percentages in RC ($M = 61.47$, $SD = 25.29$), SSL ($M = 53.62$, $SD = 21.16$), and PV ($M = 57.21$, $SD = 27.12$). They also showed that knowledge percentages for RV were significantly higher ($M = 76.06$, $SD = 24.44$) than the percentages in RC, SSL, and PV. Significantly higher percentages were also found in RC when compared to SSL and PV. Finally, pairwise comparisons also showed that the SSL subsection had significantly higher percentages than in PV subsection. There was no significant interaction between hours of research conducted per week and knowledge percent for the knowledge subsections ($F(3.59, 139) = 0.303$, $p = .857$). The subsection knowledge percentage means and standard deviations for hours of research conducted per week are presented in Table 7.

Comfort

Individuals who conduct more than five hours of research per week ($M = 2.52$, $SD = 0.69$) scored significantly higher in the composite comfort section ($z = -2.243$, $p = .025$) than those who conduct less than five hours of research per week ($M = 2.25$, $SD = 0.58$).

Significantly higher comfort scores were attained by individuals who conduct more than five hours of research per week in both the basic-knowledge section ($z = -2.012$, $p = .044$) and advance-knowledge section ($z = -2.597$, $p = .009$). The comfort means and standard deviations for the basic and advance knowledge sections are presented in Table 8.

Individuals who conduct more than five hours of research per week achieved significantly higher comfort scores in both the EBPC subsection ($z = -1.987$, $p = .047$) and RC ($z = -4.585$, $p = .000$). There were no statistically significant differences for comfort found in the RV subsection ($z = -1.751$, $p = .080$), SSL ($z = -1.363$, $p = .173$), or PV ($z = -1.580$, $p = .114$). The comfort means and standard deviations for the knowledge subsections are presented in Table 8.

Importance

Individuals who conduct more than five hours of research per week ($M = 3.44$, $SD = 0.45$) scored significantly higher in the composite importance section ($z = -2.615$, $p = .009$) than those conduct less than five hours of research per week ($M = 3.24$, $SD = 0.49$).

Statistically significant differences were not found in the basic-knowledge section in regards to hours per week of research ($z = -1.605$, $p = .108$). However, statistically significant differences were found for importance levels in the advance-knowledge section ($z = -2.605$, $p = .009$). The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 9.

Individuals who conduct more than five hours of research per week attained significantly higher importance scores in the RC subsection ($z = -2.974$, $p = .003$) as well as in SSL ($z = -2.322$, $p = .020$). There were no statistically significant differences for importance found in EBPC ($z = -1.875$, $p = .061$), RV ($z = -0.996$, $p = .319$), or PV ($z = -1.920$, $p = .055$). The comfort means and standard deviations for the knowledge subsections are presented in Table 9.

"Evidence-Based"-Related Workshops

Knowledge

There was no significant difference for composite knowledge percent ($F(1,139) = 2.97$, $p < .087$) in regards to "evidence-based"-related workshops previously attended. There was a significant main effect for knowledge percent ($F(1,139) = 114.39$, $p < .001$) for basic and advance-knowledge sections. Individuals had significantly higher percentages in the basic-knowledge section ($M = 73.84$, $SD = 16.08$) than in the advance-knowledge section ($M = 56.74$, $SD = 10.36$). There was no significant interaction between "evidence-based"-related workshops previously attended and knowledge percent for basic and advance-knowledge sections ($F(1,139) = 0.38, p = .539$). The basic and advance knowledge percentage means and standard deviations for "evidence-based"-related workshops previously attended are presented in Table 10.

There was a significant main effect for knowledge percent ($F(4, 139) = 26.51, p < .001$) for the individual five knowledge subsections. Pairwise comparisons showed that the knowledge percentages for the EBPC were significantly higher ($M = 72.06$, $SD = 20.82$) than the percentages in RC ($M = 61.47$, $SD = 25.29$), SSL ($M = 53.62$, $SD = 21.16$), and PV ($M = 57.21$, $SD = 27.12$). They also showed that knowledge percentages for RV were significantly higher ($M = 76.06$, $SD = 24.44$) than the percentages in RC, SSL, and PV. Significantly higher percentages were also found in RC when compared to SSL and PV. Finally, pairwise comparisons also showed that the SSL subsection had significantly higher percentages than in the PV subsection. There was no significant interaction between "evidence-based"-related workshops previously attended and knowledge percent for the knowledge subsections ($F(4, 139) = 0.602, p = .661$). The subsection knowledge percentage means and standard deviations for "evidence-based"-related workshops previously attended are presented in Table 10.

Comfort

Individuals who had previously attended "evidence-based"-related workshops ($M = 2.56$, $SD = 0.66$) scored significantly higher in the composite comfort section ($z = -3.074, p = .002$) than those who had not ($M = 2.23$, $SD = 0.59$).

Individuals who had previously attended "evidence-based"-related workshops achieved significantly higher comfort scores in the basic-knowledge section compared to those who had not (z = -2.135, p = .033). These individuals also attained significantly higher comfort scores in the advance-knowledge section (z = -2.138, p = .032). The comfort means and standard deviations for the basic and advance-knowledge sections are presented in Table 11.

Individuals who had previously attended "evidence-based"-related workshops achieved significantly higher comfort scores in the EBPC subsection compared to those who had not (z = -2.466, p = .014). Individuals who had previously attended "evidence-based"-related workshops also had statistically significant higher scores in both the SSL subsection (z = -2.484, p = .013) and PV subsection (z = -2.019, p = .044). There were no statistically significant differences for comfort found in the RV subsection (z = -0.152, p = .249) or in RC (z = -1.229, p = .219). The comfort means and standard deviations for the knowledge subsections are presented in Table 11.

Importance

There was not a statistically significant difference between individuals who had previously attended "evidence-based"-related workshops (M = 3.36, SD = 0.41) and individuals who had not (M = 3.32, SD = 0.53) in regards to composite importance scores (z = -0.316, p = .752).

Individuals who had previously attended "evidence-based"-related workshops attained significantly higher importance scores in the basic-knowledge section compared to those who had not (z = -3.105, p = .002). However, statistically significant differences were not found for importance levels in the advance-knowledge section (z = -0.383, p = .702). The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 12.

Individuals who had previously attended EBP-related workshops achieved significantly higher importance scores in the EBPC subsection (z = -3.316, p = .001). However, there were no statistically significant differences for importance found in the remaining four knowledge subsections (z_{RV} = -1.761, p_{RV} = .078), (z_{RC} = -0.391, p_{RC} = .696), (z_{SSL} = -0.131, p_{SSL} = .896), (z_{PV} = -0.461, p_{PV} = .645). The importance means and standard deviations for the knowledge subsections are presented in Table 12.

Years of Athletic Training Teaching Experience

Knowledge

A Pearson Correlation revealed no statistically significant correlation (r = .060, p = .478) between the number of years of athletic training teaching experience (M = 9.81, SD = 7.19) and composite knowledge percentages (M =64.43, SD = 13.48).

There were no statistically significant correlations found between the number of years of athletic training teaching experience and basic-knowledge section percentages (r = .004, p = .965), or the advance-knowledge section percentages (r = .089, p = .296). The knowledge percentage means and standard deviations for the basic and advance knowledge sections are presented in Table 13.

There were no statistically significant correlations for knowledge percentages found in any of the knowledge subsections (r_{EBPC} = .021, p_{EBPC} = .809), (r_{RV} = -.016, p_{RV} = .850), (r_{RC} = .071, p_{RC} = .403), (r_{SSL} = .062, p_{SSL} = .464), (r_{PV} = .045, p_{PV} = .593). The knowledge percentage means and standard deviations for the knowledge subsections are presented in Table 13.

Comfort

A Spearman Correlation revealed no statistically significant correlation ($r_s = .048$, $p = .573$) between the number of years of athletic training teaching experience ($M = 9.81$, $SD = 7.19$) and composite comfort scores ($M = 2.38$, $SD = 0.65$).

There were no statistically significant correlations found between the number of years of athletic training teaching experience and basic-knowledge comfort scores ($r_s = -.023$, $p = .785$), or the advance-knowledge comfort scores ($r_s = .061$, $p = .475$). The comfort means and standard deviations for the basic and advance knowledge sections are presented in Table 13.

There were no statistically significant correlations for comfort scores found in any of the knowledge subsections ($r_{sEBPC} = .001$, $p_{EBPC} = .991$), ($r_{sRV} = -.058$, $p_{RV} = .496$), ($r_{sRC} = .097$, $p_{RC} = .254$), ($r_{sSSL} = -.007$, $p_{SSL} = .936$), ($r_{sPV} = .094$, $p_{PV} = .270$). The comfort means and standard deviations for the knowledge subsections are presented in Table 13.

Importance

A Spearman Correlation revealed no statistically significant correlation ($r_s = -.031$, $p = .715$) between the number of years of athletic training teaching experience ($M = 9.81$, $SD = 7.19$) and composite importance scores ($M = 3.34$, $SD = 0.48$).

There were no statistically significant correlations found between the number of years of athletic training teaching experience and basic-knowledge importance scores ($r_s = .011$, $p = .901$), or the advance-knowledge section scores ($r_s = -.017$, $p = .843$). The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 13.

There were no statistically significant correlations for importance scores found in any of the knowledge subsections ($r_{sEBPC} = .021, p_{EBPC} = .801$), ($r_{sRV} = .010, p_{RV} = .905$), ($r_{sRC} = -.051, p_{RC} = .549$), ($r_{sSSL} = -.017, p_{SSL} = .843$), ($r_{sPV} = -.014, p_{PV} = .869$). The importance means and standard deviations for the knowledge subsections are presented in Table 13.

Hours Per Week of Academic Coursework

Knowledge

There was a significant difference for composite knowledge percent ($F(1,139) = 10.30, p = .002$) in regards to hours of academic work conducted per week. Individuals who conduct more than forty hours of academic work per week ($M = 67.47, SD = 12.48$) scored significantly higher percentages than individuals who do not ($M = 60.33, SD = 13.80$).

There was a significant main effect for knowledge percent ($F(1,139) = 113.57, p < .001$) for basic and advance-knowledge sections. Individuals scored significantly higher percentages in the basic-knowledge section ($M = 73.84, SD = 16.91$) than in the advance-knowledge section ($M = 56.74, SD = 16.08$). There was no significant interaction between hours of academic coursework conducted per week and knowledge percent for basic and advance-knowledge sections ($F(1,139) = 0.382, p = .538$). The basic and advance knowledge percentage means and standard deviations for hours of academic work conducted per week are presented in Table 14.

There was a significant main effect for knowledge percent ($F(3.59, 139) = 27.03, p < .001$) for the individual five knowledge subsections. Pairwise comparisons showed that the knowledge percentages for the EBPC were significantly higher (M = 72.06, SD = 20.82) than the percentages in RC (M = 61.47, SD = 25.29), SSL (M = 53.62, SD = 21.16), and PV (M = 57.21, SD = 27.12). They also showed that knowledge percentages for RV were significantly higher (M = 76.06, SD = 24.44) than the percentages in RC, SSL, and PV. Significantly higher percentages were also found in RC when compared to SSL and PV. Finally, pairwise comparisons also showed that the SSL subsection scored significantly higher percentages than in PV subsection. There was no significant interaction between hours of academic work conducted per week and knowledge percent for the knowledge subsections (F(3.59, 139) = 1.947, p = .109). The subsection knowledge percentage means and standard deviations for hours of academic work conducted per week are presented in Table 14.

Comfort

There was not a statistically significant difference between individuals who conduct more than forty hours of academic coursework per week (M = 2.43, SD = 0.69) and individuals who do not (M = 2.31, SD = 0.59) in regards to composite comfort scores (z = -0.668, p = .504).

Statistically significant differences were not found in both the basic-knowledge section (z = -1.367, p = .172) and advance-knowledge section (z = - 0.520, p = .603) in regards to academic coursework. The comfort means and standard deviations for the basic and advance knowledge sections are presented in Table 15.

There were no statistically significant differences for comfort found in any of the knowledge subsections (z_{EBPC} = -1.462, p_{EBPC} = .144), (z_{RV} = -0.837, p_{RV} = .403), (z_{RC} = -

1.355, p_{RC} = .175), (z_{SSL} = -0.174, p_{SSL} = .862), (z_{PV} = -0.735, p_{PV} = .463). The comfort means and standard deviations for the knowledge subsections are presented in Table 15.

Importance

There was not a statistically significant difference between individuals who conduct more than forty hours of academic coursework per week (M = 3.34, SD = 0.48) and individuals who do not (M = 3.33, SD = 0.48) in regards to composite importance scores (z = -0.124, p = .901).

Statistically significant differences were not found in both the basic-knowledge section (z = -0.894, p = .371) and advance-knowledge section (z = - 0.062, p = .951) in regards to academic coursework. The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 16.

There were no statistically significant differences for importance found in any of the knowledge subsections (z_{EBPC} = -0.705, p_{EBPC} = .481), (z_{RV} = -1.122, p_{RV} = .262), (z_{RC} = -0.238, p_{RC} = .812), (z_{SSL} = -0.326, p_{SSL} = .744), (z_{PV} = -0.131, p_{PV} = .896). The importance means and standard deviations for the knowledge subsections are presented in Table 16.

Hours Per Week of Patient Care

Knowledge

There was no significant difference for composite knowledge percent (F(1,139) = 1.58, p = .211) in regards to hours of patient care conducted per week. There was a significant main effect for knowledge percent (F(1,139) = 114.12, p < .001) for basic and advance-knowledge sections. Individuals scored significantly higher percentages in the basic-knowledge section ($M = 73.84$, $SD = 16.91$) than in the advance-knowledge section ($M = 56.74$, $SD = 16.08$). There was no significant interaction between hours of patient care conducted per week and knowledge percent for basic and advance-knowledge sections ($F(1,139) = 0.260$, $p = .611$). The basic and advance knowledge percentage means and standard deviations for hours of patient care conducted per week are presented in Table 17.

There was a significant main effect for knowledge percent ($F(3.59, 139) = 26.62$, $p < .001$) for the individual five knowledge subsections. Pairwise comparisons showed that the knowledge percentages for the EBPC were significantly higher ($M = 72.06$, $SD = 20.82$) than the percentages in RC ($M = 61.47$, $SD = 25.29$), SSL ($M = 53.62$, $SD = 21.16$), and PV ($M = 57.21$, $SD = 27.12$). They also showed that knowledge percentages for RV were significantly higher ($M = 76.06$, $SD = 24.44$) than the percentages in RC, SSL, and PV. Significantly higher percentages were also found in RC when compared to SSL and PV. Finally, pairwise comparisons also showed that the SSL subsection scored significantly higher percentages than in the PV subsection. There was no significant interaction between hours of patient care conducted per week and knowledge percent for the knowledge subsections ($F(3.59, 139) = 0.292$, $p = .864$). The subsection knowledge percentage means and standard deviations for hours of patient care conducted per week are presented in Table 17.

Comfort

There was not a statistically significant difference between individuals who do patient care on a weekly basis ($M = 2.41$, $SD = 0.62$) and individuals who do not ($M = 2.35$, $SD = 0.68$) in regards to composite comfort scores ($z = -0.681$, $p = .496$).

Statistically significant differences were not found in both the basic-knowledge section (z = -0.913, p = .362) and advance-knowledge section (z = - 0.458, p = .647) in regards to patient care. The comfort means and standard deviations for the basic and advance knowledge sections are presented in Table 18.

There were no statistically significant differences for comfort found in any of the knowledge subsections (z_{EBPC} = -0.314, p_{EBPC} = .754), (z_{RV} = -1.262, p_{RV} = .207), (z_{RC} = -1.523, p_{RC} = .128), (z_{SSL} = -1.606, p_{SSL} = .108), (z_{PV} = -0.591, p_{PV} = .555). The comfort means and standard deviations for the knowledge subsections are presented in Table 18.

Importance

There was not a statistically significant difference between individuals who do patient care (M = 3.28, SD = 0.46) and individuals who do not (M = 3.40, SD = 0.50) in regards to composite importance scores (z = -1.481, p = .139).

Statistically significant differences were not found in both the basic-knowledge section (z = -0.056, p = .955) and advance-knowledge section (z = - 1.441, p = .150) in regards to patient care. The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 19.

There were no statistically significant differences for importance found in any of the knowledge subsections (z_{EBPC} = -0.213, p_{EBPC} = .832), (z_{RV} = -0.410, p_{RV} = .682), (z_{RC} = -1.699, p_{RC} = .089), (z_{SSL} = -1.074, p_{SSL} = .283), (z_{PV} = -1.390, p_{PV} = .164). The importance means and standard deviations for the knowledge subsections are presented in Table 19.

Implementation of an Evidence-Based Concepts Pilot Workshop

Knowledge

There was not a statistically significant difference between pre-workshop percentages (M = 66.00, SD = 13.29) and post-workshop percentages (M = 69.50, SD = 9.26) in regards to composite knowledge percent (t = -1.210, p = .257).

There were no statistically significant differences between pre-workshop and post-workshop knowledge percentages in either the basic-knowledge section (t = -0.208, p = .840) or advance-knowledge section (t = -0.802, p = .443). The knowledge means and standard deviations for the basic and advance knowledge sections are presented in Table 20.

Post-workshop knowledge percentages were significantly higher than pre-workshop percentages in the SSL subsection (t = -3.971, p = .003). However, there were no significant differences between pre-workshop and post-workshop knowledge percentages in EBPC (t = -0.840, p = .423), RV (t = 0.818, p = .434), RC (t = 0.263, p = .798), or PV (t = 0.480, p = .642). The knowledge means and standard deviations for the knowledge subsections are presented in Table 20.

Comfort

There was no statistically significant difference found between pre-workshop scores (M = 2.46, SD = 0.70) and post-workshop scores (M = 2.95, SD = 0.59) in regards to composite comfort scores (z = -1.820, p = .069).

There were no statistically significant differences between pre-workshop and post-workshop comfort scores in the basic-knowledge section (z = -1.357, p = .175). However, post-workshop comfort scores were significantly higher than pre-workshop scores in the advance-knowledge section (z = -2.094, p = .036). The comfort means and standard deviations for the basic and advance knowledge sections are presented in Table 21.

Post-Workshop comfort scores were significantly higher than pre-workshop scores in the PV subsection (z = -2.333, p = .020). However, there were no statistically significant differences between pre- and post-workshop comfort scores in the initial four knowledge subsections (z_{EBPC} = -1.190, p_{EBPC} = .234), (z_{RV} = -1.380, p_{RV} = .168), (z_{RC} = -1.437, p_{RC} = .151), (z_{SSL} = -01.549, p_{SSL} = .121). The comfort means and standard deviations for the knowledge subsections are presented in Table 21.

Importance

There was no statistically significant difference found between pre-workshop scores (M = 3.42, SD = 0.24) and post-workshop scores (M = 3.42, SD = 0.45) in regards to composite importance scores (z = -0.059, p = .953).

There were no statistically significant differences between pre-workshop and post-workshop importance scores in either the basic-knowledge section (z = -1.119, p = .263) or advance-knowledge section (t = -0.600, p = .549). The importance means and standard deviations for the basic and advance knowledge sections are presented in Table 22.

There were no statistically significant differences for importance found in any of the knowledge subsections (z_{EBPC} = -1.633, p_{EBPC} = .102), (z_{RV} = -0.780, p_{RV} = .453), (z_{RC} = -0.707, p_{RC} = .480), (z_{SSL} = -0.360, p_{SSL} = .719), (z_{PV} = -0.849, p_{PV} = .396). The importance means and standard deviations for the knowledge subsections are presented in Table 22.

Table 4. Knowledge Means and Standard Deviations for Terminal Degree

Terminal Degree (TD) vs. No Terminal Degree (NTD)				
Section	***Knowledge***			
	M		*SD*	
	TD	*NTD*	*TD*	*NTD*
Composite	69.92	59.60	10.36	14.11
Basic Section	79.46	68.89	13.95	17.81
Advance Section	62.12	52.00	12.62	17.34
EBPC Subsection	79.39	65.60	18.88	20.42
RV Subsection	79.55	73.00	20.99	26.88
RC Subsection	65.15	58.22	26.43	23.95
SSL Subsection	59.39	48.53	19.52	21.35
PV Subsection	63.64	51.56	23.19	29.15

Table 5. Comfort Means and Standard Deviations for Terminal Degree

Terminal Degree (TD) vs. No Terminal Degree (NTD)				
Section	***Comfort***			
	M		*SD*	
	TD	*NTD*	*TD*	*NTD*
Composite	2.51	2.27	0.67	0.61
Basic Section	3.33	3.26	0.56	0.53
Advance Section	2.32	2.06	0.66	0.63
EBPC Subsection	3.23	3.09	0.63	0.57
RV Subsection	3.42	3.43	0.59	0.59
RC Subsection	2.25	1.83	0.81	0.67
SSL Subsection	2.50	2.29	0.75	0.69
PV Subsection	2.14	1.96	0.69	0.75

Table 6. Importance Means and Standard Deviations for Terminal Degree

Terminal Degree (TD) vs. No Terminal Degree (NTD)				
Section	***Importance***			
	M		*SD*	
	TD	*NTD*	*TD*	*NTD*
Composite	3.39	3.29	0.46	0.50
Basic Section	3.06	2.88	0.62	0.67
Advance Section	3.29	3.18	0.52	0.55
EBPC Subsection	2.82	2.59	0.85	0.86
RV Subsection	3.30	3.18	0.55	0.62
RC Subsection	3.17	3.07	0.58	0.64
SSL Subsection	3.41	3.28	0.55	0.56
PV Subsection	3.22	3.13	0.60	0.62

Table 7. Knowledge Means and Standard Deviations for Hours of Research

More Than 5 Hours Research (MR) vs. Less Than 5 (LR)				
Section	***Knowledge***			
	M		*SD*	
	MR	*LR*	*MR*	*LR*
Composite	67.06	61.99	12.67	13.84
Basic Section	76.80	71.08	15.08	18.12
Advance Section	59.09	54.55	16.81	15.15
EBPC Subsection	74.71	69.59	19.43	21.89
RV Subsection	79.41	72.95	19.29	28.18
RC Subsection	62.75	60.27	24.11	26.44
SSL Subsection	57.06	50.41	21.38	20.58
PV Subsection	58.82	55.71	27.69	26.68

Table 8. Comfort Means and Standard Deviations for Hours of Research

More Than 5 Hours Research (MR) vs. Less Than 5 (LR)				
Section	***Comfort***			
	M		*SD*	
	MR	*LR*	*MR*	*LR*
Composite	2.52	2.25	0.69	0.58
Basic Section	3.38	3.21	0.56	0.53
Advance Section	2.33	2.05	0.71	0.57
EBPC Subsection	3.25	3.07	0.63	0.56
RV Subsection	3.51	3.34	0.57	0.59
RC Subsection	2.33	1.74	0.80	0.61
SSL Subsection	2.46	2.32	0.75	0.70
PV Subsection	2.15	1.95	0.79	0.66

Table 9. Importance Means and Standard Deviations for Hours of Research

More Than 5 Hours Research (MR) vs. Less Than 5 (LR)				
Section	***Importance***			
	M		*SD*	
	MR	*LR*	*MR*	*LR*
Composite	3.44	3.24	0.45	0.49
Basic Section	3.06	2.88	0.66	0.64
Advance Section	3.36	3.11	0.50	0.55
EBPC Subsection	2.83	2.57	0.89	0.82
RV Subsection	3.29	3.18	0.56	0.62
RC Subsection	3.29	2.95	0.53	0.64
SSL Subsection	3.45	3.25	0.54	0.56
PV Subsection	3.28	3.08	0.58	0.63

Table 10. Knowledge Means and Standard Deviations for "Evidence-Based"-Related Workshops Previously Attended

EBP Workshops (EBP) vs. No EBP Workshops (NEBP)				
Section	***Knowledge***			
	M		*SD*	
	EBP	*NEBP*	*EBP*	*NEBP*
Composite	66.56	62.66	13.62	13.19
Basic Section	76.56	71.57	17.16	16.47
Advance Section	58.38	55.37	17.05	15.20
EBPC Subsection	76.25	68.57	21.93	19.31
RV Subsection	76.95	75.32	22.85	25.81
RC Subsection	61.98	61.04	23.66	26.71
SSL Subsection	55.00	52.47	21.97	20.53
PV Subsection	60.42	54.55	30.79	23.51

Table 11. Comfort Means and Standard Deviations for "Evidence-Based"-Related Workshops Previously Attended

EBP Workshops (EBP) vs. No EBP Workshops (NEBP)				
Section	***Comfort***			
	M		*SD*	
	EBP	*NEBP*	*EBP*	*NEBP*
Composite	2.56	2.23	0.66	0.59
Basic Section	3.41	3.19	0.45	0.60
Advance Section	2.33	2.07	0.71	0.59
EBPC Subsection	3.30	3.03	0.54	0.62
RV Subsection	3.51	3.35	0.47	0.66
RC Subsection	2.13	1.94	0.82	0.71
SSL Subsection	2.55	2.25	0.75	0.68
PV Subsection	2.19	1.93	0.81	0.63

Table 12. Importance Means and Standard Deviations for "Evidence-Based"-Related Workshops Previously Attended

EBP Workshops (EBP) vs. No EBP Workshops (NEBP)				
Section	***Importance***			
	M		*SD*	
	EBP	*NEBP*	*EBP*	*NEBP*
Composite	3.36	3.32	0.41	0.53
Basic Section	3.15	2.81	0.56	0.68
Advance Section	3.24	3.22	0.46	0.60
EBPC Subsection	2.96	2.47	0.74	0.89
RV Subsection	3.34	3.15	0.51	0.64
RC Subsection	3.14	3.09	0.51	0.69
SSL Subsection	3.36	3.33	0.52	0.59
PV Subsection	3.16	3.19	0.57	0.65

Table 13. Knowledge, Comfort, and Importance Means and Standard Deviations for Years of Athletic Training Teaching Experience

Years of Athletic Training Teaching Experience						
Section	***Knowledge***		***Comfort***		***Importance***	
	M	*SD*	*M*	*SD*	*M*	*SD*
Composite	64.43	13.48	2.38	0.65	3.34	0.48
Basic Section	73.84	16.91	3.29	0.55	2.97	0.65
Advance Section	56.74	16.08	2.19	0.65	3.23	0.54
EBPC Subsection	72.06	20.82	3.16	0.60	2.70	0.86
RV Subsection	76.06	24.44	3.42	0.58	3.24	0.59
RC Subsection	61.47	25.29	2.02	0.76	3.11	0.61
SSL Subsection	53.62	21.16	2.39	0.73	3.35	0.56
PV Subsection	57.21	27.12	2.05	0.73	3.17	0.61

Table 14. Knowledge Means and Standard Deviations for Hours of Academic Coursework

More Than 40 Hours Academic Work (MAW) vs. Less Than 40 (LAW)				
Section	***Knowledge***			
	M		*SD*	
	MAW	*LAW*	*MAW*	*LAW*
Composite	67.47	12.48	60.33	13.80
Basic Section	76.40	70.37	16.89	16.45
Advance Section	60.16	52.12	14.41	17.14
EBPC Subsection	74.57	68.67	19.75	21.90
RV Subsection	78.70	72.50	24.72	23.78
RC Subsection	62.55	60.00	26.55	23.61
SSL Subsection	56.30	50.00	20.52	21.63
PV Subsection	64.20	47.78	25.15	27.01

Table 15. Comfort Means and Standard Deviations for Hours of Academic Coursework

More Than 40 Hours Academic Work (MAW) vs. Less Than 40 (LAW)				
Section	***Comfort***			
	M		*SD*	
	MAW	*LAW*	*MAW*	*LAW*
Composite	2.43	2.31	0.69	0.59
Basic Section	3.32	3.24	0.59	0.49
Advance Section	2.23	2.13	0.69	0.61
EBPC Subsection	3.20	3.09	0.65	0.52
RV Subsection	3.44	3.39	0.65	0.55
RC Subsection	2.12	1.89	0.81	0.68
SSL Subsection	2.40	2.37	0.76	0.69
PV Subsection	2.09	1.99	0.74	0.71

Table 16. Importance Means and Standard Deviations for Hours of Academic Coursework

More Than 40 Hours Academic Work (MAW) vs. Less Than 40 (LAW)				
Section	***Importance***			
	M		*SD*	
	MAW	*LAW*	*MAW*	*LAW*
Composite	3.34	3.33	0.48	0.48
Basic Section	3.01	2.91	0.67	0.62
Advance Section	3.22	3.25	0.55	0.53
EBPC Subsection	2.73	2.64	0.88	0.83
RV Subsection	3.28	3.18	0.60	0.57
RC Subsection	3.11	3.12	0.60	0.63
SSL Subsection	3.33	3.37	0.59	0.52
PV Subsection	3.16	3.19	0.64	0.58

Table 17. Knowledge Means and Standard Deviations for Hours of Patient Care

Patient Care (PC) vs. No Patient Care (NPC)				
Section	***Knowledge***			
	M		*SD*	
	PC	*NPC*	*PC*	*NPC*
Composite	62.97	65.83	14.07	12.84
Basic Section	72.79	74.85	16.78	17.09
Advance Section	54.94	58.46	17.67	14.30
EBPC Subsection	70.14	73.89	22.39	19.17
RV Subsection	76.09	76.04	25.16	23.90
RC Subsection	60.39	62.50	25.74	24.98
SSL Subsection	51.60	55.56	21.80	20.48
PV Subsection	55.07	59.26	26.71	27.53

Table 18. Comfort Means and Standard Deviations for Hours of Patient Care

Patient Care (PC) vs. No Patient Care (NPC)				
Section	***Comfort***			
	M		*SD*	
	PC	*NPC*	*PC*	*NPC*
Composite	2.41	2.35	0.62	0.68
Basic Section	3.26	3.31	0.49	0.60
Advance Section	2.21	2.17	0.64	0.67
EBPC Subsection	3.15	3.16	0.53	0.66
RV Subsection	3.38	3.47	0.55	0.62
RC Subsection	1.93	2.12	0.77	0.75
SSL Subsection	2.48	2.30	0.71	0.73
PV Subsection	2.07	2.02	0.71	0.75

Table 19. Importance Means and Standard Deviations for Hours of Patient Care

Patient Care (PC) vs. No Patient Care (NPC)				
Section	***Importance***			
	M		*SD*	
	PC	*NPC*	*PC*	*NPC*
Composite	3.28	3.40	0.46	0.50
Basic Section	2.97	2.97	0.65	0.65
Advance Section	3.17	3.29	0.49	0.57
EBPC Subsection	2.68	2.71	0.83	0.90
RV Subsection	3.25	3.22	0.61	0.57
RC Subsection	3.02	3.20	0.62	0.60
SSL Subsection	3.30	3.39	0.51	0.59
PV Subsection	3.12	3.23	0.52	0.69

Table 20. Knowledge Means and Standard Deviations for Workshop Implementation

Implementation of an Evidence-Based Concepts Pilot Workshop				
Section	***Knowledge***			
	M		*SD*	
	Pre	*Post*	*Pre*	Post
Composite	66.00	69.50	13.29	9.26
Basic Section	76.67	77.78	11.05	21.60
Advance Section	57.27	62.73	16.63	9.04
EBPC Subsection	76.00	84.00	15.78	29.51
RV Subsection	77.50	70.00	24.86	28.38
RC Subsection	60.00	56.67	26.29	31.63
SSL Subsection	56.00	92.50	24.59	16.87
PV Subsection	56.67	50.00	31.62	28.33

Table 21. Comfort Means and Standard Deviations for Workshop Implementation

Implementation of an Evidence-Based Concepts Pilot Workshop				
Section	***Comfort***			
	M		*SD*	
	Pre	*Post*	*Pre*	*Post*
Composite	2.46	2.95	0.70	0.59
Basic Section	3.00	3.28	0.62	0.62
Advance Section	2.25	2.77	0.66	0.62
EBPC Subsection	2.90	3.10	0.57	0.77
RV Subsection	3.10	3.45	0.74	0.50
RC Subsection	2.10	2.65	0.84	0.82
SSL Subsection	2.47	2.87	0.72	0.76
PV Subsection	2.10	2.75	0.61	0.63

Table 22. Importance Means and Standard Deviations for Workshop Implementation

Implementation of an Evidence-Based Concepts Pilot Workshop				
Section	***Importance***			
	M		*SD*	
	Pre	*Post*	*Pre*	*Post*
Composite	3.42	3.42	0.24	0.45
Basic Section	3.75	3.58	0.26	0.50
Advance Section	3.23	3.33	0.32	0.44
EBPC Subsection	3.75	3.55	0.42	0.50
RV Subsection	3.75	3.60	0.35	0.52
RC Subsection	3.00	3.10	0.24	0.52
SSL Subsection	3.43	3.50	0.61	0.53
PV Subsection	3.15	3.30	0.34	0.48

CHAPTER V

DISCUSSION & CONCLUSIONS

Discussion

Evidence-based practice concepts vary from a basic understanding to more advanced comprehension. As assessed on the *Evidence-Based Concepts for Clinical Practice Assessment*, athletic training educators' overall knowledge percentage was considered to be low with an average of 64.4%. A main effect was found within the survey instrument between the basic and advance-level questions; educators performed better on the basic-level (EBPC & RV) questions than on the more advance-level (RC, SSL, PV) questions. Therefore, the more difficult the evidence-based concepts became, the lower the scores were on the instrument. Although 64.4% is considered relatively low for knowledge assessment, subjects of this analysis scored similarly to other pre-workshop groups previously examined. Fritsche et al. examined a group of health professionals prior to a 3-day EBP workshop and found mean knowledge scores via the *Berlin Questionnaire* to be 6.3 out of 15 (42%) (Fritsche, 2002). Similarly, Nicholson et al. evaluated a sample of allied health clinical educators and found their pre-workshop knowledge scores via the *Fresno Test* to be 57.9% (Nicholson, et al., 2007). However, it is important to note that the knowledge percentages attained from these research studies were collected as long as five to ten years ago. Since then, these health professions have taken several essential steps in improving evidence-based practice knowledge levels of clinicians. Therefore, it is necessary to reevaluate the larger population of both athletic training educators and clinicians to gain a better perspective of the content areas EBP workshops and courses should be focusing on.

Before it can be expected that athletic training students comprehend evidence-based concepts, it is important to determine an educator's comfort level for implementing such concepts into their didactic curriculum. Overall comfort scores assessed within this study averaged at 2.4 out of 4, indicating that the majority of athletic training educators felt relatively uncomfortable with their content knowledge of the eleven evidence-based concepts. Educators felt slightly more comfortable with the basic-level questions such as reliability and validity. However, comfort levels decreased the more complex a concept became, particularly with reliability coefficients and predictive values. Similar pre-intervention comfort scores (2.8 out of 5) were found in allied health clinical educators that were asked to assess their confidence levels of online skills for access to medical knowledge and support of EBP teaching (Nicholson, et al., 2007).

Along with knowledge and comfort, it is also important to appraise athletic training educators' beliefs towards the importance of implementing particular evidence-based concepts within athletic training diagnostic coursework. As assessed on the instrument, educators held the beliefs that the eleven evidence-based concepts evaluated were important for implementation; overall importance scores averaged at 3.3 out of 4 (82.5%). Interestingly, educators believed the more advanced evidence-based concepts were just as important for implementation as the basic foundations. In a similar assessment of physiotherapists' attitudes and beliefs towards EBP, it was found that 90% of the subjects believed evidence-based practice was important and necessary (Jette, et al., 2003). Therefore, it is evident that athletic trainers along with other health care professionals believe EBP is a necessary component for the enhancement of allied health.

Overall, athletic training educators current knowledge, comfort, and importance scores appear to be at similar levels to where other allied health educators once were. Although the numbers may look the same, it is important to point out that the data collected from other allied health professions has since then been followed up with workshops, short-courses, and programs, along with continued post-intervention analyses. Furthermore, our baseline assessment of evidence-based practice in athletic training educators occurred for other professions as long as ten years ago. Only recently has the athletic training profession begun to incorporate EBP concepts and information into workshops and publications such as the *Journal of Athletic Training* (Hootman, 2004).

It is evident that athletic training educators and clinicians believe evidence-based practice is a necessary component for incorporation into the profession (Bostic, 2009; Hertel, 2005). Currently, focus is slowly beginning to shift away from the basics of what evidence-based practices entails towards ways to facilitate the implementation of EBP into education (Bostic, 2009). However, the knowledge, comfort, and importance levels for EBP implementation must steadily increase before athletic training can be considered an evidence-based profession.

Terminal Degree

We hypothesized that athletic training educators with a terminal degree would score higher knowledge percentages as well as higher comfort and importance scores on the *Evidence-Based Concepts for Clinical Practice Assessment* than athletic training educators without a terminal degree. We found that educators with a terminal degree attained significantly higher composite knowledge percentages and composite comfort scores; however, no difference in importance scores between the two groups was found. More specifically, educators with a terminal degree felt more comfortable with the advanced evidence-based concepts, particularly the reliability coefficients, sensitivity, specificity, and likelihood ratios.

Generally, individuals pursuing a terminal degree are required to become more competent in statistical analyses (Hertel, et al., 2001). Doctoral education programs typically entail more courses in statistical concepts, therefore leading the individual to greater skill levels of data synthesis, breakdown, and critical appraisal. These skills are further enhanced by a dissertation and numerous research projects associated with a terminal degree. Furthermore, individuals with a terminal degree may often be in position that requires continual research publications for promotion and tenure (Hertel, et al., 2001; Kronenfeld, et al., 2007; Starkey & Ingersoll, 2001). Such requirements automatically expose these individuals to tasks that an individual without a terminal degree may not carry. Thus, we would expect to see individuals with a terminal degree score higher on the *Evidence-Based Concepts for Clinical Practice Assessment* than individuals without a terminal degree. Interestingly, however, both individuals with a terminal degree and those without felt similarly in regards to the importance of implementing evidence-based concepts into athletic training curricula. This similarity between groups could be due to the various barriers pertaining to workload and assignment time, which therefore could significantly affect educators' attitudes towards the importance of new concepts, regardless of the type of degree they hold.

Hours Per Week of Research

It was hypothesized that athletic training educators who spend more than five hours per week on research would achieve higher percentages and scores on the knowledge, comfort, and importance sections of the survey instrument. We found that educators who conducted more than five hours of research per week scored significantly higher composite percentages on the knowledge section as well as higher composite scores on the two calibration sections. These educators felt more comfortable with both the basic and advance sections, particularly the evidence-based practice concepts and reliability coefficient sections. They also regarded the reliability coefficients, sensitivity, specificity, and likelihood ratios to be of greater importance for implementation than individuals who did not conduct more than five hours of research per week.

Normally, individuals who conduct research on a weekly basis spend more time focusing on data synthesis and critical appraisal. Performing research can include a wide variety of tasks; research design, data collection and synthesis, conducting statistical analyses, critically appraising results as well as other research studies, and deducting conclusions from a given data set are just a few of the many components of conducting research. Due to the increased focus on statistical processes, individuals who conduct research on a weekly basis are more likely to have a better understanding of the fundamental evidence-based concepts, and therefore perform better on the *Evidence-Based Concepts for Clinical Practice Assessment*. Similarly, we would expect to find that individuals who conduct research on a weekly basis to believe the incorporation of EBP concepts into the curriculum are more important.

"Evidence-Based"-Related Workshops

It was hypothesized that athletic training educators who had previously attended "evidence-based practice"-related workshops would attain higher knowledge, comfort, and importance percentages and scores. In regards to overall knowledge percentages, the findings did not support our initial hypothesis; there were no significant differences found between the two groups. However, athletic training educators who had previously attended EBP workshops achieved significantly higher overall composite comfort scores. Furthermore, these individuals reported significantly higher comfort scores for not only the evidence-based practice concepts subsection, but also for the more advance sections, including sensitivity, specificity, likelihood ratios, and predictive values. Finally, although no significant differences were found for overall importance scores, athletic training educators who had previously attended EBP workshops indicated significantly higher importance scores for the fundamental evidence-based concepts.

Several "evidence-based"-related workshops have been made available to athletic trainers at both the district and national levels over the past several years (Best, Irrgang, Fritz, & Worrell, 2004). However, the majority of these workshops are introductory and solely focus on what evidence-based practice is and how it is needed in athletic training to help promote and further enhance the profession. Advance-level workshops detailing higher-level statistical concepts are available, however very few suggest ways to carry this knowledge over into the classroom. Although workshops typically do not change a clinician's daily practices (Coomarasamy, 2004), they have been found to change attitudes and perceptions (Stevenson, et al., 2004). Individuals who have previously attended "evidence-based"-related workshops may have scored higher on the importance scale because they have already been introduced to the concepts and therefore agree with its importance for implementation. Individuals who have never attended an "evidence-based"-related workshop before however, may not fully comprehend the fundamentals of the EBP concepts and therefore deem them unimportant.

Years of Athletic Training Teaching Experience

We hypothesized that there would be a positive relationship between the number of years an educator has been teaching athletic training coursework and knowledge, comfort, and importance percentages/scores on the *Evidence-Based Concepts for Clinical Practice Assessment*. However, the findings revealed that there were no correlations for knowledge, comfort, or importance and therefore did not support our initial hypotheses.

Although it might be suspected that an individual who has taught athletic training longer may score higher on the survey instrument, more information is needed to determine the true relationship. Furthermore, the participants of this study were not required to identify which courses they were instructing, how long they had been instructing each particular course, as well as if they consecutively taught a specific class or taught various classes each academic year. Additionally, some educators may be more willing to incorporate evidence-based practice into their curriculum; however their motives were not assessed and cannot currently be identified. Unfortunately, our analysis of the relationship between years of athletic training teaching experience and knowledge, comfort, and importance levels of evidence-based concepts cannot be compared to previous research as very few to no preceding studies conducted had assessed the years of teaching experience among their subjects.

Hours Per Week of Academic Coursework

It was hypothesized that there would be no significant differences in knowledge, comfort, and importance between athletic training educators who conduct more than forty hours of academic coursework per week and those who conduct less than forty. Contrary to our initial hypothesis, educators who conduct more than 40 hours of academic coursework per week scored significantly higher composite knowledge percentages. However, in support of our initial hypotheses, there were no significant differences revealed in either comfort or importance sections of the instrument. Similarly to the results found in years of athletic training teaching experience, although significant knowledge differences were found, we are unaware as to how these educators are classifying academic coursework. Academic coursework can include numerous tasks such as mentoring and advising students, curriculum preparation, in-class instruction, among several other administrative responsibilities (Judd & Perkins, 2004). Thus, although further research needs to be conducted to specify how these educators classify academic coursework, individuals who spend more than 40 hours per week are typically more likely to examine research more frequently. Individuals who spend less than 40 hours per week on academic coursework generally have other responsibilities occupying their time, such as the various duties in the clinical setting.

Hours Per Week of Patient Care

We hypothesized that there would be no significant differences in knowledge, comfort, and importance between athletic training educators who performed patient care on a weekly basis and those who did not. The findings support our initial hypotheses in that there were in fact no significant differences revealed in any of three survey sections assessed.

Although some educators may not conduct patient care on a weekly basis, they most likely have numerous other responsibilities that fill their time. Program directors, for example, have responsibilities in teaching, administration, service, and research (Bordage, et al., 2000), leaving very little to no spare time for patient care. Therefore, regardless if an individual is conducting patient care, athletic training clinicians and educators carry extremely full workloads that may prevent them from taking the time to learn evidence-based practice as well as discover ways to implement it into their already demanding schedules.

Implementation of an Evidence-Based Concepts Pilot Workshop

We hypothesized that there would be no significant differences between pre-workshop and post-workshop scores on the three sections of the *Evidence-Based Concepts for Clinical Practice Assessment*. No significant differences were found in the importance section, therefore supporting our initial hypothesis. However in regards to the knowledge section, although no significant differences were found overall or in the basic and advance sections, post-workshop percentages were significantly higher in the subsection including sensitivity, specificity, and likelihood ratios. It was also revealed that post-workshop comfort scores increased in the advance-level sections, particularly with the predictive value concepts. Retrospectively, the number of workshop participants was smaller than anticipated; therefore the results of this analysis may not have as great of an effect as we may normally expect.

Due to the five-hour duration of this single-day workshop, athletic training educators may have left with feelings of being overwhelmed from the abundant amount of EBP information provided. This pilot workshop not only combined both introductory and higher level evidence-based concepts for implementation into didactic and clinical education, but also included two additional sections (*Incorporating Clinical Prediction Rules into Entry Level Education* and *Incorporating Systematic Reviews into Entry-Level Education*) that did not relate to the contents of the survey. For some participants, this may have been their inaugural introduction to evidence-based practice concepts and implementation techniques; therefore their importance levels may have stayed the same because they still are not convinced of its need into the curriculum. However, since most workshops are found to change participants' attitudes (Coomarasamy, 2004; Stevenson, et al., 2004), it is no surprise that post-workshop comfort levels were increased.

While the assessment of the effects of evidence-based practice on the independent variables within this study are important, the larger focus must currently remain on the global issues of EBP implementation within the athletic training profession. Overall, the main goal of this allied health care profession is to improve patient care (A. Snyder, et al., 2007). However, such improvements require evidence that treatment plans and clinical decisions are not only effective and produce positive results, but are also the most time and cost efficient for the patient and clinician. To do so, we must produce evidence-based clinicians that will routinely search the evidence for the optimal treatment methods and interventions for each patient or problem. Unfortunately, without the implementation of

EBP into didactic and clinical athletic training education, such clinicians may never be available.

As previously mentioned, there are numerous obstacles preventing evidence-based practice into both the clinical setting and classroom. Clinicians tend to believe that EBP will lead to cookbook practices that will neglect the goals and concerns of the patient (Haynes, 2002). Furthermore, time, lack of EBP knowledge, and unwillingness to change their practices have been other barriers preventing various allied healthcare professionals from accepting evidence-based practice (Bidwell, 2004). In the classroom, several questions and challenges have prevented educators from also incorporating EBP. Previously, educators have hesitated towards implementation due to the uncertainty of teaching ambiguity. Evidence-based practice requires clinicians to question current interventions and search for appropriate evidence supporting or refuting those decisions. However, an educator may question how to proceed with instruction when there is no evidence available for a particular concept (H. G. Welch & Lurie, 2000). Similarly, educators may not be willing to accept a new method of teaching that creates new reservations (Johnston & Fineout-Overholt, 2005). To implement evidence-based practice, educators and clinical instructors must be ready to admit to such uncertainties so that they may move toward the novelty of being an evidence-based clinician and educator.

Interestingly, many athletic training educators are already implementing the tools necessary for evidence-based practice without realizing it. Problem-based learning, a teaching strategy that has been adequately incorporated into many athletic training education programs, allows students to enhance their critical thinking and problem solving skills; two tasks essential for the evidence-based clinician (Heinrichs, 2002). With problem-based learning and various other active-learning strategies engraved into the curriculum, transformations to incorporate evidence-based concepts should become relatively easy. To further add to the simple transition, many athletic training education programs have already begun to implement research methods courses into the curriculum. Such classes also augment a student's critical thinking ability, as well as provide them with a basic understanding of some of the important statistical concepts within EBP. Even though research methods concepts are currently most often not introduced to the athletic training students until later in their undergraduate career, if at all, it is one step in the right direction. In the upcoming years, program directors should not only focus to make sure research concepts are included into the curriculum, but to also shift research methods components to the freshman and sophomore level so that students will have more time to digest and incorporate statistical concepts and critical thinking skills into their developing practices.

Although transforming athletic training education programs to incorporate evidence-based practice may be relatively straightforward, the process cannot begin if program directors and educators are not prepared. Conveniently, several studies have revealed that numerous evidence-based practice workshops and short courses have been proven effective in other allied healthcare professions. Such workshops have also been made available for athletic trainers at both the district and national levels. However, the majority of these sessions generally have discussed what evidence-based practice is, instead of delving into teaching specific concepts and providing ways for implementation into curriculum and clinical practice. Athletic training continuing education units (CEUs) have also been awarded to individuals completing certain workshops, courses, and quizzes on evidence-based practice; however with the numerous CEUs available annually for an athletic trainer to complete, individuals may opt to choose to earn CEUs in content areas they are more comfortable with.

The single-day workshop offered within this study focused to provide a pilot group of athletic training educators with the knowledge of the primary evidence-based and statistical concepts, as well as explore ways to incorporate such fundamentals into didactic and clinical education. Although significant differences were not found with overall knowledge levels after the workshop, an informal critique via evaluation forms of participants' perceptions of the session indicated that the workshop was beneficial and should be repeated at the national level. Therefore, instead of focusing on the definition of evidence-based practice and where athletic training is in regards to its incorporation, future workshops and short-course sessions should concentrate on improving educators' knowledge of the necessary EBP concepts needed for successful implementation.

One of the most difficult tasks for a presenter is determine which information should be included in a workshop or short-course, and which details should be disregarded. In regards to evidence-based practice, there should be a clear differentiation between introductory and advance level workshops. Introductory workshops should typically include information pertaining to the basics of EBP as well as literature searching and critical appraisal, while more advance courses should focus on higher-level statistical concepts (Yousefi-Nooraie, et al., 2007). Introductory workshops that are offered most often change attitudes of the participants, however many individuals do not usually change their practices after attending a single workshop or short course

(Coomarasamy, 2004). Furthermore, including information about advance level concepts in an introductory workshop may overwhelm a participant and therefore decrease their willingness for incorporation into clinical practice even more. Thus, future workshops and short-courses must be carefully distinguished between introductory and basic so that clinicians will not be engulfed with new information for implementation into their daily practices.

Along with increasing evidence-based practice knowledge levels of athletic training educators, focus must also be given to improving comfort levels of EBP content. Typically, the more knowledge a clinician has about a particular concept, the more confident and comfortable they are. Therefore, by focusing on the quality and prevalence of EBP workshops and short courses to include applicable information, educators will gradually become more comfortable with their content knowledge of evidence-based concepts. Furthermore, since this study revealed that educators believe the identified EBP concepts are important for incorporation into the curriculum, these increased comfort levels may also enhance their willingness to begin implementation.

To maintain accreditation, it is required that each athletic training education program comply with the educational standards as developed by CAATE. These standards are used to prepare entry-level athletic trainers and provide the minimum academic requirements for the ATEP (Sexton, 2008). Due to the in-depth nature, if a component is not included in these standards, it is generally not emphasized within an athletic training education program. Therefore, for the athletic training profession to progress towards evidence-based practice, future revisions of the CAATE standards should begin to incorporate the fundamental EBP concepts. By making these concepts a requirement for implementation, athletic training educators will have no choice but to improve their content knowledge and comfort levels of incorporating evidence-based practice into their curriculum. Ultimately, the overall goal of the athletic training profession is to improve patient outcomes. Thus, by beginning with revisions of the CAATE standards, the inevitable incorporation of evidence-based practice will hopefully escalate through both educational and clinical practices to bring athletic trainers one step closer in the right direction.

Limitations

Certain limitations existed within this study that may have affected the results. To begin, the subjects in this study were not a random sample of the population. Athletic training educators registered for the 2009 Athletic Training Educators' Conference were assessed; therefore the subject group was a population of convenience. Next, there was a possibility that participants had different interpretations of the survey questions than the research team intended. To combat these issues, questions were developed to be as clear and to the point as possible with the least amount of directions required.

An additional limitation to this study is that the pre-conference pilot workshop, *Evidence-Based Concepts for Clinical Practice Education: A Study Investigating the Effectiveness of a Single-Day Workshop*, was not the only "evidence-based"-related workshop taking place the day it was offered. Another pre-conference workshop, *Evidence Based Practice: Assessing Athletic Training Outcomes*, took place in the same afternoon, and the locations of each workshop were unclear. Furthermore, educators were unsure of which evidence-based practice workshop they were registered for, and as a result individuals were mistakenly attending the incorrect session. To account for this confusion, two members of the research team stood outside each workshop to help direct registrants to their appropriate destination. Additionally, contact information was collected during our pre-conference workshop so that the correct attendees would be contacted for the post-workshop survey assessment.

Finally, definitions of the independent variables within this study were a limitation. Due to the already extensive length of the survey instrument, operational definitions were excluded for each individual variable. Participants were therefore free to interpret demographics such as years of athletic teaching experience, hours of research, patient care, academic work per week, and "evidence-based"-related workshops however suited them best.

Conclusions

The purpose of this study was to first determine the knowledge, comfort, and importance levels of evidence-based practice concepts and principles by CAATE accredited athletic training educators. The second purpose was to examine the effectiveness of a pilot workshop designed to provide information related to the evaluation of EBP concepts linked to diagnostic testing. The key information presented by this study is beneficial in providing a baseline of where athletic training educators currently stand in regards to evidence-based practice. This baseline is particularly important in identifying the direction and need for further research. Considering the results of this study, there is a definite need for the further education of athletic training educators in regards to evidence-based practice concepts, with a specific focus placed on distinguishing strategies for implementation into didactic curricula. The results of this study further indicated that single-day workshops focusing on evidence-based practice might be an effective way to increase knowledge and calibration levels of athletic training educators as well as educate them on how to implement evidence-based concepts into diagnostic courses.

Research on the knowledge, comfort, and importance levels of athletic training educators and clinicians is severely limited. Therefore, future research should focus to examine not only a larger population of athletic training didactic and clinical educators, but also athletic training clinicians. Additional single-day workshops also need to be designed and further assessed on a larger sample of participants. Furthermore, evidence-based practice teaching models should be developed for implementation into athletic training diagnostic coursework. Finally, long-term, research should begin to focus on the incorporation of EBP into clinical practices for entry-level athletic training graduates.

REFERENCES

Altman, D., & Bland, J. (1994). Statistics natoes: diagnostic tests 2: predictive values. *BMJ, 309*, 102.

Athletic Training Education Overview (2008). *National Athletic Trainer's Association*, 1-2.

Banning, M. (2005). Conceptions of evidence, evidence-based medicine, evidence-based practice and their use in nursing: independent nurse prescribers' views. *J Clin Nurs, 14*, 411-417.

Bartko, J. (1976). On various intraclass correlation reliability coefficients. *Psychology Bulletin, 83*, 762-765.

Best, T., Irrgang, J., Fritz, J., & Worrell, T. (2004). Evidence-Based Athletic Training Workshop Series. *NATA Education Council - Continuing Education Subcommittee.*

Bhandari, M., & Guyatt, G. (2005). How to appraise a diagnostic test. *World J Surg, 29*, 561-566.

Bidwell, S. R. (2004). Finding the evidence: resources and skills for locating information on clinical effectiveness. *Singapore medical journal, 45*(12), 567-572, quiz 573.

Bigby, M. (1998). Evidence-based medicine in a nutshell. A guide to finding and using the best evidence in caring for patients. *Arch Dermatol, 134*(12), 1609-1618.

Bilsker, D. (2004). Teaching Evidence-Based Practice: Overcoming Barriers. *Brief Treatment and Crisis Intervention, 4*(3), 271-275.

Bleakley, C. (2002). The quality of research in sports journals. *British Journal of Sports Medicine, 36*(2), 124-125.

Bordage, G., Foley, R., & Goldyn, S. (2000). Skills and attributes of directors of educational programmes. *MEDICAL EDUCATION-OXFORD-*.

Bostic, J. (2009). Brown Prepares for Leadership Role. *NATA News*(April), 26.

CAATE (2009). Commission on Accreditation of Athletic Training Education, from www.caate.net

CAATE Clinical Education Terminology (2009). *National Athletic Trainers' Association.*

Carr, W., & Drummond, J. L. (2002). Collaboration Between Athletic Training Clinical and Classroom Instructors. *Journal of athletic training, 37*(4 Suppl), S182-S188.

Charles-Liscombe, R. S. (2007). A national survey of athletic training educators' academic role strain, role orientation, and intent .... *gradworks.umi.com*.

Ciliska, D. (2006). Evidence-based nursing: how far have we come? What's next? *Evidence-Based Nursing, 9*(2), 38-40.

Coomarasamy, A. (2004). What is the evidence that postgraduate teaching in evidence based medicine changes anything? A systematic review. *BMJ, 329*(7473), 1017-1010.

Cordova, M. L. (2007). Giving clinicians more to work with: let's incorporate confidence intervals into our data. *Journal of athletic training, 42*(4), 445.

Cornesky, R. A. (1992). Using Deming To Improve Quality in Colleges and Universities. *eric.ed.gov*.

Craig, J., Irwig, L., & Stockler, M. (2001). Evidence-based medicine: useful tools for decision making. *The Medical Journal of Australia, 174*, 248-253.

Delforge, G. D., & Behnke, R. S. (1999). The History and Evolution of Athletic Training Education in the United States. *Journal of athletic training, 34*(1), 53-61.

Delwiche, F., & Hall, E. (2007). Mapping the literature of athletic training. *J Med Libr Assoc, 95*(2), 195-201.

DePalma, J. (2007). The value of evidence-based continuing education. *Journal of continuing education in nursing, 38*(2), 52.

Fineoutoverholt, E., Melnyk, B., & Schultz, A. (2005). Transforming Health Care from the Inside Out: Advancing Evidence-Based Practice in the 21st Century. *Journal of Professional Nursing, 21*(6), 335-344.

Fisher, C. G., & Dvorak, M. (2005). Orthopaedic Research: what an orthopaedic surgeon needs to know. *Orthopaedic Knowledge Update 8*, 3-13.

Fisher, C. G., & Wood, K. B. (2007). Introduction to and techniques of evidence-based medicine. *Spine, 32*(19 Suppl), S66-72.

Force, N. A. T. A. E. T. (1997). Recommendations to reform athletic training education. *NATA News*(February), 16-24.

Forrest, J. L., & Miller, S. A. (2002). Evidence-based decision making in action: Part 1--Finding the best clinical evidence. *The journal of contemporary dental practice, 3*(3), 10-26.

Forrest, J. L., & Miller, S. A. (2003). Evidence-based decision making in action: Part 2--evaluating and applying the clinical evidence. *The journal of contemporary dental practice, 4*(1), 42-52.

Foster, D. T., & Leslie, D. K. (1992). Clinical Teaching Roles of Athletic Trainers. *Journal of athletic training, 27*(4), 298-302.

Fritsche, L. (2002). Do short courses in evidence based medicine improve knowledge and skills? Validation of Berlin questionnaire and before and after study of courses in evidence based medicine. *BMJ, 325*(7376), 1338-1341.

Fritz, J. M., & Wainner, R. S. (2001). Examining diagnostic tests: an evidence-based perspective. *Physical therapy, 81*(9), 1546-1564.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-607.

Grace, P. (1999). Milestones in Athletic Trainer Certification. *Journal of athletic training, 34*(3), 285-291.

Green, J., & Britten, N. (1998). Qualitative research and evidence based medicine. *British Medical Journal, 316*(7139), 1230-1232.

Haynes, R. (2002). What kind of evidence is it that Evidence-Based Medicine advocates want health care providers and consumers to pay attention to? *BMC Health Serv Res, 2*(1), 3.

Heater, B., Becker, A., & Olson, R. (1988). Nursing interventions and patients outcomes: a meta-analysis of studies. *Nurs Res., 37*(5), 303-307.

Hegedus, E. (2009). Beyond spPIN and SnNOUT: considerations with dichotomous tests during assessment of diagnostic accuracy. *The Journal of Manual and Manipulative Therapy, 17*(1), 1-5.

Heinrichs, K. I. (2002). Problem-Based Learning in Entry-Level Athletic Training Professional-Education Programs: A Model for Developing Critical-Thinking and Decision-Making Skills. *Journal of athletic training, 37*(4 Suppl), S189-S198.

Hertel, J. (2005). Research Training for Clinicians: The Crucial Link Between Evidence-Based Practice and Third-Party Reimbursement. *Journal of athletic training, 40*(2), 69-70.

Hertel, J., West, T. F., Buckley, W. E., & Denegar, C. R. (2001). Educational History, Employment Characteristics, and Desired Competencies of Doctoral-Educated Athletic Trainers. *Journal of athletic training, 36*(1), 49-56.

Hootman, J. (2004). New Section in JAT: Evidence-Based Practice. *Journal of athletic training, 39*(1), 9-9.

Houston, T. K., Ferenchick, G. S., Clark, J. M., & Bowen, J. L. (2004). Faculty development needs. *J Gen Intern Med.*

Jette, D. U., Bacon, K., Batty, C., Carlson, M., Ferland, A., Hemingway, R. D., et al. (2003). Evidence-based practice: beliefs, attitudes, knowledge, and behaviors of physical therapists. *Physical therapy, 83*(9), 786-805.

Johnson, B. (2001). Toward a new classification of nonexperimental quantitative research. *Educational Researcher, 30*(2), 3.

Johnston, L., & Fineout-Overholt, E. (2005). Teaching EBP: "Getting from zero to one." Moving from recognizing and admitting uncertainties to asking searchable, answerable questions. *Worldviews on evidence-based nursing / Sigma Theta Tau International, Honor Society of Nursing, 2*(2), 98-102.

Joppe, M. (2000). The Research Process Retrieved April 28, 2009, from http://www.ryerson.ca/~mjoppe/rp.htm

Judd, M. R., & Perkins, S. A. (2004). Athletic Training Education Program Directors' Perceptions on Job Selection, Satisfaction, and Attrition. *Journal of athletic training, 39*(2), 185-192.

Killeen, M. B., & Barnfather, J. S. (2005). A successful teaching strategy for applying evidence-based practice. *Nurse educator, 30*(3), 127-132.

Kronenfeld, M., Stephenson, P., Nail-Chiwetalu, B., Tweed, E., Sauers, E., Mcleod, T., et al. (2007). Review for librarians of evidence-based practice in nursing and the allied health professions in the United States. *J Med Libr Assoc, 95*(4), 394-407.

Lauber, C. A., Toth, P. E., Leary, P. A., Martin, R. D., & Killian, C. B. (2003). Program Directors' and Clinical Instructors' Perceptions of Important Clinical-Instructor Behavior Categories in the Delivery of Athletic Training Clinical Instruction. *Journal of athletic training, 38*(4), 336-341.

Laurent, T., & Weidner, T. G. (2001). Clinical Instructors' and Student Athletic Trainers' Perceptions of Helpful Clinical Instructor Characteristics. *Journal of athletic training, 36*(1), 58-61.

Leard, J., Booth, C., & Johnson, J. (1991). A study of career pathways of NATA curriculum program directors. *Athl Train J Natl Athl Train Assoc, 26*, 211-214.

Lijmer, J., Mol, B., & Heisterkamp, S. (1999). Empirical evidence of design-related bias in studies of diagnostic tests. *JAMA, 282*, 1061-1066.

MacCormick, M. (1995). The changing role of the nurse teacher. *Nursing standard (Royal College of Nursing (Great Britain) : 1987), 10*(2), 38-41.

Mackinnon, R. (2007). Evidence based medicine methods (part 1): the basics. *Pediatric Anesthesia, 17*(10), 918-923.

McColl, A., Smith, H., White, P., & Field, J. (1998). General practitioners' perceptions of the route to evidence based medicine: a questionnaire survey. *British Medical Journal, 316*(7128), 361-365.

McCombe, P., Fairbank, J., Cockersole, B., & Pynsent, P. (1989). Reproducibility of physical signs in low-back pain. *Spine, 14*, 908-918.

McGinn, T., Wyer, P. C., Newman, T. B., Keitz, S., Leipzig, R., For, G. G., et al. (2004). Tips for learners of evidence-based medicine: 3. Measures of observer variability (kappa statistic). *CMAJ : Canadian Medical Association journal journal de l'Association medicale canadienne, 171*(11), 1369-1373.

Medina, J. M., McKeon, P. O., & Hertel, J. (2006). EVIDENCE BASED MEDICINE Rating the Levels of Evidence in Sports-Medicine Research. *humankinetics.com*.

Merideth, E. M. (2007). Leadership strategies for teachers. *books.google.com*.

Meyer, L. P. (2002). Athletic Training Clinical Instructors as Situational Leaders. *Journal of athletic training, 37*(4 Suppl), S261-S265.

Moher, D., Pham, B., Jones, A., Cook, D., Jadad, A., Moher, M., et al. (1998). Does quality of reports of randomised trials affect estimates of intervention efficacy reported in meta-analyses? *Lancet, 352*(9128), 609-613.

Montori, V. M., Kleinbart, J., Newman, T. B., Keitz, S., Wyer, P. C., Moyer, V., et al. (2004). Tips for learners of evidence-based medicine: 2. Measures of precision (confidence intervals). *CMAJ : Canadian Medical Association journal journal de l'Association medicale canadienne, 171*(6), 611-615.

Newell, W. (1984). Reflections on Athletic Training. *Athl Train, JNATA, 19*, 256-259.

Nicholson, L. J., Warde, C. M., & Boker, J. R. (2007). Faculty training in evidence-based medicine: improving evidence acquisition and critical appraisal. *The Journal of continuing education in the health professions, 27*(1), 28-33.

O'Shea, M. (1980). A History of the National Athletic Trainers Association. *National Athletic Trainers Association*.

Peer, K. S., & Rakich, J. S. (2000). Accreditation and Continuous Quality Improvement In Athletic Training Education. *Journal of athletic training, 35*(2), 188-193.

Perkins, S. A., & Judd, M. R. (2001). Dilemmas of Program Directors: Then and Now. *Journal of athletic training, 36*(4), 396-400.

Perrin, D. (2007). Athletic Training: From Physical Education to Allied Health. *Quest, 59*(1), 13.

Petrie, A. (2006). Statistics in orthopaedic papers. *Journal of Bone & Joint Surgery, 88*, 1121-1136.

Phillips, B., Ball, C., Badenoch, D., Straus, S., Haynes, B., & Dawes, M. (2001). Oxford Centre for Evidence-based Medicine Levels of Evidence

Portney, L., & Watkins, M. (2000). *Foundations of Clinical Research: Applications to Practice* (2nd ed.). Upper Saddle River, NJ: Prentice Hall Health.

Ramos, K. (2003). Validation of the Fresno test of competence in evidence based medicine. *BMJ, 326*(7384), 319-321.

Romanello, M. L., & Martin, M. (2006). Information Literacy in Athletic Training: A Problem-Based Approach. *Athletic Therapy Today*.

Saarinen-Rahiika, H., & Binkley, J. M. (1998). Problem-based learning in physical therapy: a review of the literature and overview of the McMaster University experience. *Physical therapy, 78*(2), 195-207; discussion 207-111.

Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: what it is and what it isn't. *BMJ, 312*(7023), 71-72.

Sciera, J. (1981). The role of the NATA program director. *Athl Train J Natl Athl Train Assoc, 16*, 125-126.

Sexton, P. (2008). Standards for the Accreditation of Entry-Level Athletic Training Education Programs. *Commission on Accrediation of Athletic Training Education*, 1-19.

Shaneyfelt, T., Baum, K. D., Bell, D., Feldstein, D., Houston, T. K., Kaatz, S., et al. (2006). Instruments for evaluating education in evidence-based practice: a systematic review. *JAMA, 296*(9), 1116-1127.

Sheehan, K. (2001). E-mail survey response rates: a review. *Journal of Computer Mediated Communication*(January).

Shlonsky, A. (2004). Will the Real Evidence-Based Practice Please Stand Up? Teaching the Process of Evidence-Based Practice to the Helping Professions. *Brief Treatment and Crisis Intervention, 4*(2), 137-153.

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: uses in assessing rater reliability. *Psychological bulletin, 86*(2), 420-428.

Smith, C. A., Ganschow, P. S., Reilly, B. M., Evans, A. T., McNutt, R. A., Osei, A., et al. (2000). Teaching residents evidence-based medicine skills: a controlled trial of effectiveness and assessment of durability. *J Gen Intern Med, 15*(10), 710-715.

Snyder, A., McLeod, T. V., & Sauers, E. (2007). Defining, Valuing, and Teaching Clinical Outcomes Assessment in Professional and Post-Professional Athletic Training Education Programs. *Athletic Training Education Journal, 2*, 31-41.

Snyder, A. R., Parsons, J. T., Valovich McLeod, T. C., Curtis Bay, R., Michener, L. A., & Sauers, E. (2008). Using disablement models and clinical outcomes assessment to enable evidence-based athletic training practice, part I: disablement models. *Journal of athletic training, 43*(4), 428-436.

Starkey, C., & Ingersoll, C. (2001). Scholarly Productivity of Athletic Training Faculty Members. *Journal of athletic training, 36*(2), 156-159.

Stevenson, K., Lewis, M., & Hay, E. (2004). Do physiotherapists' attitudes towards evidence-based practice change as a result of an evidence-based educational programme? *J Eval Clin Pract, 10*(2), 207-217.

Steves, R., & Hootman, J. M. (2004). Evidence-Based Medicine: What Is It and How Does It Apply to Athletic Training? *Journal of athletic training, 39*(1), 83-87.

Straus, S., Ball, C., Balcombe, N., Sheldon, J., & Mcalister, F. (2005). Teaching Evidence-based Medicine Skills Can Change Practice in a Community Hospital. *J Gen Intern Med, 20*(4), 340-343.

Turocy, P. S. (2002). Survey Research in Athletic Training: The Scientific Method of Development and Implementation. *Journal of athletic training, 37*(4 Suppl), S174-S179.

Valovich McLeod, T. C., Snyder, A. R., Parsons, J. T., Curtis Bay, R., Michener, L. A., & Sauers, E. (2008). Using disablement models and clinical outcomes assessment to enable evidence-based athletic training practice, part II: clinical outcomes assessment. *Journal of athletic training, 43*(4), 437-445.

Vargha, P. (1997). A critical discussion of intraclass correlation coefficients. *Stat Med, 16*, 821-823.

Weidner, T. G., & Henning, J. M. (2002). Historical Perspective of Athletic Training Clinical Education. *Journal of athletic training, 37*(4 Suppl), S222-S228.

Weidner, T. G., & Henning, J. M. (2004). Development of Standards and Criteria for the Selection, Training, and Evaluation of Athletic Training Approved Clinical Instructors. *Journal of athletic training, 39*(4), 335-343.

Weidner, T. G., & Henning, J. M. (2005). Importance and applicability of approved clinical instructor standards and criteria to certified athletic trainers in different clinical education settings. *Journal of athletic training, 40*(4), 326-332.

Welch, C., Yakuboff, M., & Madden, M. (2008). Critically Appraised Papers and Topics Part 1: Use in Clinical Practice. *Athletic Therapy Today, 13*(5), 1-3.

Welch, H. G., & Lurie, J. D. (2000). Teaching evidence-based medicine: caveats and challenges. *Academic medicine : journal of the Association of American Medical Colleges, 75*(3), 235-240.

Williamson, J., Goldschmidt, P., & Colton, T. (1986). *The quality of medical literature: an analysis of validation assessments*. Waltham, MA: NEJM Books.

Wingerchuk, D., & Demaerschalk, B. (2007). Critically appraised topics: the evidence-based neurologist. *Neurologist, 13*(1), 1.

Yousefi-Nooraie, R., Rashidian, A., Keating, J. L., & Schonstein, E. (2007). Teaching evidence-based practice: the teachers consider the content. *J Eval Clin Pract, 13*(4), 569-575.

Zinberg, S. (1997). Evidence-based practice guidelines: a current perspective. *Obstetrical & gynecological survey, 52*(5), 265-266.

APPENDIX A

Evidence-Based Concepts for Clinical Practice Assessment

Evidence-Based Concepts for Clinical Practice Assessment

Assessment of Diagnostic Concepts for Evidence-Based Clinical Practice

The purpose of this study is to assess the knowledge, comfort, and importance levels of evidence-based practice principles and concepts of CAATE accredited athletic training educators before and after a single day workshop entitled, *Evidence-Based Concepts for Clinical Practice Education: A Study Investigating the Effectiveness of a Single-Day Workshop*.

This survey is broken into three sections:

1. Knowledge Assessment (20 Multiple Choice questions)
2. Calibration Assessment (22 Likert Scale questions)
3. Demographic Questionnaire

The survey will take you approximately 25-30 minutes to complete. Please read all questions and answer them to the best of your ability. Your completion of this survey will be considered your consent to participate in this study. All information that you provide will be kept confidential. Upon completion of each survey page press the NEXT button and the next page of questions will appear. If you need to stop the survey and return to it later, please press the SAVE button. This will allow you to start the survey from where you left off.

At the end of the survey you will have the opportunity to request the results of the study as well as enter for a chance to win a gift certificate. Thank you in advance for your participation.

Assessment of Diagnostic Concepts for Evidence-Based Clinical Practice

Part One: Knowledge Assessment

1. Evidence-based practice involves consideration of which of the following:
   a. Patient goals and needs
   b. Clinician expertise
   c. Best research results
   d. All of the above

2. The first step of the EBP process is to:
   a. Search for research literature
   b. Critically appraise the current research
   c. Define a clinical question
   d. Select a database to utilize

3. Which of the following databases solely encompasses systematic reviews?
   a. MEDLINE
   b. Cochrane
   c. SportsDiscus
   d. PEDRo

4. Which of the following is considered the "gold standard" of experimental research design?
   a. Case report
   b. Clinical observation
   c. Prospective cohort
   d. Randomized controlled trial

5. According to the Centre of Evidence-Based Medicine Level of Evidence scale, a level of ______ relates to the highest level of evidence for a diagnostic test:
   a. 1
   b. A
   c. 5
   d. C

6. Increasing the number of evaluators for a diagnostic test helps to determine:
   a. Intra-rater reliability
   b. Inter-rater reliability
   c. Validity
   d. Confidence interval

7. Conducting a study to assess if a diagnostic test is actually evaluating what it is reported to evaluate describes which EBP concept?
   a. Reliability
   b. Validity
   c. Predictability
   d. Homogeneity

8. Which statistical concept assesses a diagnostic test to determine its reproducibility?
   a. Reliability
   b. Validity
   c. Sensitivity
   d. Specificity

9. The Ottawa Ankle Rules are found to have high ____________________; they do an excellent job of correctly diagnosing ankle injuries in adults.
   a. Validity
   b. Reliability
   c. Likelihood ratio
   d. Kappa coefficient

10. To correct for diagnostic findings that occur due to chance, which of the following statistics would NOT be applicable?
   a. Likelihood ratio
   b. Intra-class correlation coefficient
   c. Kappa coefficient
   d. All of the above are used to correct for diagnostic findings that occur due to chance

11. If the Kappa coefficient of a particular diagnostic test is 0.83, then this test's inter-rater agreement would be considered:
   a. Poor
   b. Moderate
   c. Good
   d. Very Good

12. Which of the following statistical concepts indicates strength of a relationship between two repeated measures?
   a. Likelihood ratio
   b. Intra-class correlation coefficient
   c. Reliability
   d. Sensitivity

13. If a diagnostic test is considered to be 100% specific, then:
    a. A negative test will capture everyone who has the disease
    b. A positive test will capture everyone who has the disease
    c. A negative test will capture everyone who does not have the disease
    d. A positive test will capture everyone who does not have the disease

14. The higher the sensitivity for a diagnostic test:
    a. The more likely a positive finding will rule the disorder out
    b. The more likely a negative finding will rule the disorder out
    c. The more likely a positive finding will rule the disorder in
    d. The more likely a negative finding will rule the disorder in

15. After conducting a literature search of knee instability tests, you have selected the best diagnostic test. This ideal test has a:
    a. High sensitivity and high specificity
    b. High sensitivity and low specificity
    c. Low sensitivity and high specificity
    d. Low sensitivity and low specificity

16. At the ABC University athletic training clinic, the prevalence of post-surgical ganglion cyst reoccurrence is 30%. One hundred consecutive patients have been included in a study for a new non-invasive diagnostic test for detection of ganglion cysts. Of these 100 patients, 63 are recognized as truly negative (i.e., truly free of a ganglion cyst). The number of false positive and false negative patients is identical. Which one of the 4 tables best describes this information?

A	Gold Standard Positive	Gold Standard Negative	
Test Positive	23	7	30
Test Negative	7	63	70
	30	70	100 Patients

B	Gold Standard Positive	Gold Standard Negative	
Test Positive	30	0	30
Test Negative	0	70	70
	30	70	100 Patients

C	Gold Standard Positive	Gold Standard Negative	
Test Positive	27	10	37
Test Negative	3	60	63
	30	70	100 Patients

D	Gold Standard Positive	Gold Standard Negative	
Test Positive	30	7	37
Test Negative	7	56	63
	37	63	100 Patients

a. A
b. B
c. C
d. D

17. Which of the following terms combines sensitivity and specificity to indicate a shift in probability?
a. Likelihood ratio
b. Positive predictive value
c. Negative predictive value
d. Intra-class correlation coefficient

18. Comparing the true rate to the overall rate is indicative of which of the following EBP concepts?
a. Reliability
b. Likelihood ratio
c. Intra-class correlation coefficient
d. Predictive value

19. After conducting an extensive literature search, you have found a new diagnostic technique that has a positive likelihood ratio of 2.2 and a negative likelihood ratio of 0.2. The results of this test:
a. Generate large and often conclusive shifts in probability
b. Generate moderate shifts in probability
c. Generate small but somewhat important shifts in probability
d. Alter probability to a small and rarely important degree

20. Using the table below, please indicate which of the following produces the correct negative predictive value:

	Gold Standard Positive	Gold Standard Negative	
Test Positive	23	7	30
Test Negative	7	63	70
	30	70	100 Patients

a. 7/70
b. 63/70
c. 70/7
d. 70/63

Assessment of Diagnostic Concepts for Evidence-Based Clinical Practice

Part Two: Calibration Assessment

Please note that there are two responses to each of the following EBP concepts. The first response will assess the educator's comfort level towards their ability to implement the specified EBP concept. The second response will identify the educator's beliefs towards the importance for implementation of the specified EBP concept.

In the first response, please assess your feelings towards your own content knowledge using these choices:

EBP Concept Implementation Comfort
A. I am ***very comfortable*** with my content knowledge of this EBP concept
B. I am ***comfortable*** with my content knowledge of this EBP concept
C. I am ***uncomfortable*** with my content knowledge of this EBP concept
D. I am ***very uncomfortable*** with my content knowledge of this EBP concept

In the second response, please assess your beliefs towards the importance for implementation using these choices:

EBP Concept Implementation Importance
A. This EBP concept is ***very important*** for implementation
B. This EBP concept is ***important*** for implementation
C. This EBP concept is ***unimportant*** for implementation
D. This EBP concept is ***very unimportant*** for implementation

Assessment of Diagnostic Concepts for Evidence-Based Clinical Practice

Part Two: Calibration Assessment

"Definition" of Evidence-Based Practice

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Steps of Evidence-Based Practice

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Reliability

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Validity

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Intra-Class Correlation Coefficient

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Kappa Coefficient

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Specificity

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
    a. Very important
    b. Important
    c. Unimportant
    d. Very unimportant

Sensitivity

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
    a. Very comfortable
    b. Comfortable
    c. Uncomfortable
    d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
   a. Very important
   b. Important
   c. Unimportant
   d. Very unimportant

Likelihood Ratios

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
   a. Very comfortable
   b. Comfortable
   c. Uncomfortable
   d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
   a. Very important
   b. Important
   c. Unimportant
   d. Very unimportant

Positive Predictive Values

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
   a. Very comfortable
   b. Comfortable
   c. Uncomfortable
   d. Very uncomfortable

2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
   a. Very important
   b. Important
   c. Unimportant
   d. Very unimportant

Negative Predictive Values

1. Are you comfortable with your ability to implement this EBP concept within diagnostic assessment coursework?
   a. Very comfortable
   b. Comfortable
   c. Uncomfortable
   d. Very uncomfortable

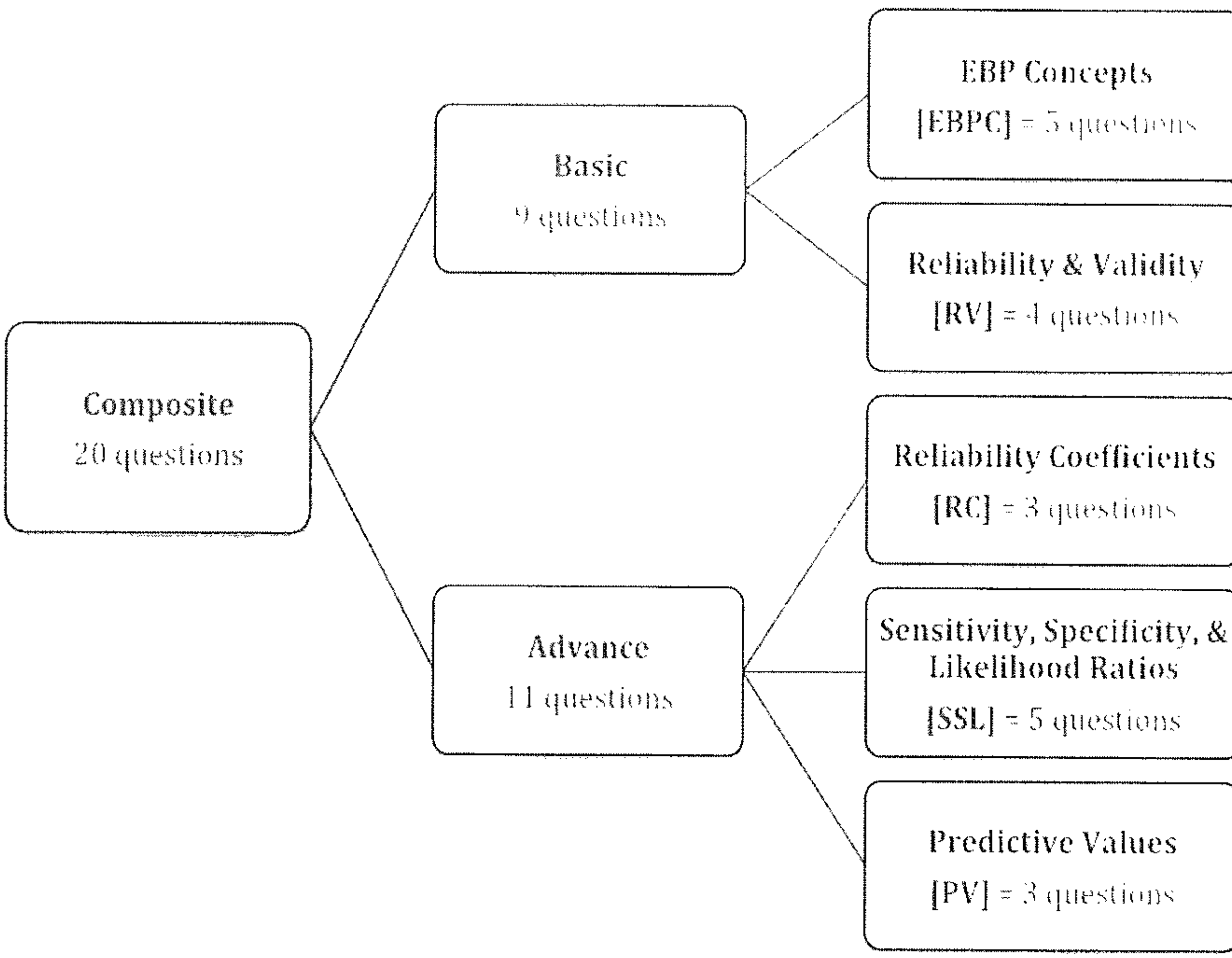
2. How important do you believe this EBP concept is for implementation within diagnostic assessment coursework?
   a. Very important
   b. Important
   c. Unimportant
   d. Very unimportant

Thank you for your time and participation in this study. All comments and questions should be directed towards:

Cailee E. Welch, ATC
Graduate Student, Post-Professional Athletic Training Program
Old Dominion University
cewelch@odu.edu

Your answers will be submitted after you press the FINISH button below.

If you are interested in receiving the results of this study or if you would like to enter a drawing for the chance to win one of ten $10.00 Visa gift cards, then please fill in your current e-mail address below. The results of the study will be sent to you upon the completion of the study (if you requested) and the winners of the gift certificates will be notified via e-mail.


Composite
20 questions
Basic
9 questions
Advance
11 questions
EBP Concepts
[EBPC] = 5 questions
Reliability & Validity
[RV] = 4 questions
Reliability Coefficients
[RC] = 3 questions
Sensitivity, Specificity, &
Likelihood Ratios
[SSL] = 5 questions
Predictive Values
[PV] = 3 questions

Assessment of Diagnostic Concepts for Evidence-Based Clinical Practice

Demographic Information – General

1. Age: ____________

2. Gender:
    a. Male
    b. Female

3. Ethnicity:
    a. African American
    b. Asian
    c. Caucasian
    d. Latin American
    e. Native American
    f. Pacific Islander
    g. Other ____________________

4. How many years of experience do you have as a certified athletic trainer? ________

Demographic Information – Academic

1. Which of the following degrees have you earned? (Check all that apply)
    a. Bachelors degree
    b. Masters degree
    c. PhD
    d. EdD
    e. MD
    f. DO
    g. PA
    h. Other ______________________

2. What year did you receive your most recent educational degree? ________________

3. Please indicate the type(s) of athletic training education program(s) you are associated with? (Check all that apply)
    a. CAATE accredited undergraduate athletic training education program
    b. CAATE accredited entry-level masters athletic training education program
    c. Accredited post-professional masters athletic training education program
    d. Doctoral education

4. Are you currently working towards obtaining a terminal degree?
    a. Yes
    b. No

5. How many years have you been teaching athletic training coursework? ____________

6. How many years you have held your current academic position. ____________

7. What is your current academic rank?
    a. Instructor or Lecturer
    b. Assistant Professor
    c. Associate Professor
    d. Full Professor
    e. Clinical Specialist/Faculty
    f. Other ______________________________

8. What is your current tenure status?
    a. Tenured
    b. Tenure-Track
    c. Non-Tenure Track

9. On average, how many hours per week do you work academically? _______________

Demographic Information – Clinical

1. Are you currently acting as a Clinical Instructor (CI) or Approved Clinical Instructor (ACI) for a CAATE accredited athletic training education program?
    a. Yes
    b. No

2. On average, how many students do you clinically supervise per year? ____________

3. Which of the following best describes the setting at which you do most of your patient care?
    a. College/University
    b. High School
    c. Clinic
    d. Hospital
    e. Military
    f. Performing Arts
    g. Industrial
    h. I do not do patient care
    i. Other ______________________________

4. How many full-time certified athletic trainers (including yourself) are in the facility in which you do the majority of your patient care? ____________

5. Which of the following job titles most closely describes your current position in the athletic training facility?
  a. Head Athletic Trainer
  b. Assistant Athletic Trainer
  c. Graduate Assistant Athletic Trainer
  d. Director of Sports Medicine
  e. I do not work in the athletic training facility
  f. Other ______________________

6. On average, how many hours per week do you work clinically? __________

Demographic Information – Research

1. Which source(s) do you utilize to support your instruction of orthopedic diagnostic testing? (Check all that apply)
  a. Textbook
  b. Database
  c. Clinical expertise
  d. None of the above

2. If you were to research evidence to support the use of knee instability tests, which database would you utilize most frequently to obtain current research literature?

____

3. When was the last time you utilized a database to research a topic of interest? (in days) __________

4. Have you previously participated in or been involved with a randomized controlled trial?
  a. Yes
  b. No

5. How many Evidence-Based Medicine/Practice title related workshops have you attended in the past year? (This may include lecture series, formal training, course-work, etc.) __________

6. On average, how many hours per week do you spend on research (including research discussion, literature review, data analysis, etc.)? __________

Demographic Information – Athletic Training Education Program

1. What division is the institution in which you are affiliated with?
    a. NCAA Division I
    b. NCAA Division II
    c. NCAA Division III
    d. NAIA
    e. NJCAA
    f. NCCAA
    g. Other ___________________________

2. How many years has the athletic training education program you are affiliated with been accredited? ____________

3. How many total students (officially admitted) does the athletic training education program you are affiliated with currently enroll? ____________

4. How many approved clinical instructors are affiliated with the athletic training education program? ____________

5. How many educational instructors teach formalized athletic training courses in the athletic training education program you are affiliated with?

6. What is the structure of your institution's academic calendar?
    a. Semester
    b. Semester with January term
    c. Trimester
    d. Quarter
    e. Other ___________________________

7. How many total weeks per year does your athletic training education program encompass? ____________

Demographic Information – Summary

1. Please indicate the percentage of your total work time that you spend in each type of activity during an average month? (Total must equal 100%).

Teaching Percentage: ____________
Administration Percentage: ____________
Service Percentage: ____________
Research Percentage: ____________
Patient Care Percentage: ____________

Educators' Conference Workshops

1. Please identify the 2009 ATEC Pre-Conference Workshop you attended:
    a. Best Practices in Athletic Training and Accreditation
    b. Preparing a Useful Manuscript Review
    c. Strategies for Millennial Students and Candidates: Beyond Multiple Choice Examinations
    d. Evidence Based Practice: Assessing Athletic Training Outcomes
    e. Utilizing Web 2.0 Technology in the Curriculum
    f. Evidence-Based Concepts for Clinical Practice Education: A Study Investigating the Effectiveness of a Single-Day Workshop
    g. I did not attend a Pre-Conference Workshop
    h. Other ______________________________

APPENDIX D

Reliability Raw Data by Question

Question 1*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	4	4
2	4	4
3	4	4
4	4	4
5	4	4
6	4	4

* The correct answer for question 1 is 4.

Question 2*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	3	3
2	3	3
3	3	3
4	4	1
5	3	3
6	3	3

* The correct answer for question 2 is 3.

Question 3*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	2	2
2	2	2
3	2	2
4	2	2
5	2	2
6	2	2

* The correct answer for question 3 is 2.

Question 4*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	4	4
2	4	4
3	4	4
4	4	4
5	4	4
6	4	4

* The correct answer for question 4 is 4.

Question 5*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	3	3
2	2	2
3	1	1
4	1	1
5	2	2
6	1	2

* The correct answer for question 5 is 1.

Question 6*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	1	2
2	2	2
3	2	2
4	2	2
5	2	2
6	2	2

* The correct answer for question 6 is 2.

Question 7*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	2	2
2	2	2
3	2	2
4	2	2
5	2	2
6	2	2

* The correct answer for question 7 is 2.

Question 8*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	1	1
2	1	1
3	1	1
4	1	1
5	1	1
6	3	1

* The correct answer for question 8 is 1.

Question 9*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	3	1
2	1	1
3	1	3
4	1	1
5	2	2
6	1	1

* The correct answer for question 9 is 1.

Question 10*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	2	4
2	4	3
3	2	2
4	4	3
5	4	4
6	1	1

* The correct answer for question 10 is 1.

Question 11*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	3	3
2	4	3
3	3	3
4	3	3
5	4	4
6	3	4

* The correct answer for question 11 is 3.

Question 12*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	2	3
2	2	2
3	1	2
4	3	3
5	1	1
6	2	2

* The correct answer for question 12 is 2.

Question 13*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	3	3
2	2	3
3	3	3
4	2	2
5	3	3
6	2	3

* The correct answer for question 13 is 3.

Question 14*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	3	3
2	2	3
3	3	3
4	1	1
5	3	3
6	3	3

* The correct answer for question 14 is 2.

Question 15*		
Subject Number	*Trial 1 Response*	*Trial 2 Response*
1	1	1
2	1	1
3	1	2
4	1	1
5	3	1
6	1	1

* The correct answer for question 15 is 1.

Question 16*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	1	1
2	4	4
3	2	1
4	1	1
5	1	1
6	1	1

* The correct answer for question 16 is 1.

Question 17*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	1	1
2	1	1
3	1	1
4	2	1
5	1	1
6	2	2

* The correct answer for question 17 is 1.

Question 18*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	4	4
2	4	2
3	4	4
4	3	4
5	4	4
6	4	4

* The correct answer for question 18 is 4.

Question 19*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	3	3
2	3	3
3	1	1
4	3	1
5	3	1
6	1	1

* The correct answer for question 19 is 3.

Question 20*		
Subject Number	***Trial 1 Response***	***Trial 2 Response***
1	2	2
2	2	2
3	1	1
4	3	2
5	2	4
6	2	1

* The correct answer for question 20 is 2.

APPENDIX E

Pre-Conference Letter of Instruction Sample

Dear ________________________________,

As a registrant of the 2009 Athletic Training Educators' Conference we would like to invite you to participate in a pre-conference survey assessment. The purpose of this evaluation is to assess the knowledge, importance, and comfort levels of evidence-based practice diagnostic concepts of athletic training educators and clinicians. This research study is being conducted by Sara Brown, MS, ATC, Bonnie Van Lunen, PhD, ATC, Stacy Walker, PhD, ATC, and Cailee Welch, ATC, and has been approved by the Human Subjects Committee of the College of Education at Old Dominion University.

The pre-conference online survey (link attached below) will take approximately 20-30 minutes to complete and should be submitted by February 19, 2009. At the conclusion of the conference, a subgroup may be identified to participate in a post-conference assessment.

It is our hope that the information gathered from this study will guide us to bring athletic training educators and clinicians one step closer to effectively implementing EBP into athletic training didactic curricula.

Thank you for your time,

Cailee Welch, ATC
Old Dominion University
cewelch@odu.edu

Link to Survey: https://periwinkle.ts.odu.edu/surveys/5WN2EK/

APPENDIX F

Pilot Workshop Outline and Primary Content

Evidence-Based Concepts for Clinical Practice Education:
A Study Investigating the Effectiveness of a Single-Day Workshop

WORKSHOP SCHEDULE

1:00pm – 1:10pm – Welcome

1:10pm – 2:40pm – Evidence in Diagnosis
~ Sara Brown, MS, ATC

2:40pm – 2:50pm – Break

2:50pm – 4:10pm – Round-Table Discussion
~ Mark Laursen, MS, ATC

4:10pm – 4:15pm – Break

4:15pm – 4:30pm – Incorporating Clinical Prediction Rules into Entry Level Education
~ Bonnie Van Lunen, PhD, ATC

4:30pm – 4:55pm – Incorporating Systematic Reviews into Entry-Level Education
~ Jay Hertel, PhD, ATC

4:55pm – 5:00pm – Conclusion/Workshop Evaluation

Evidence in Diagnosis

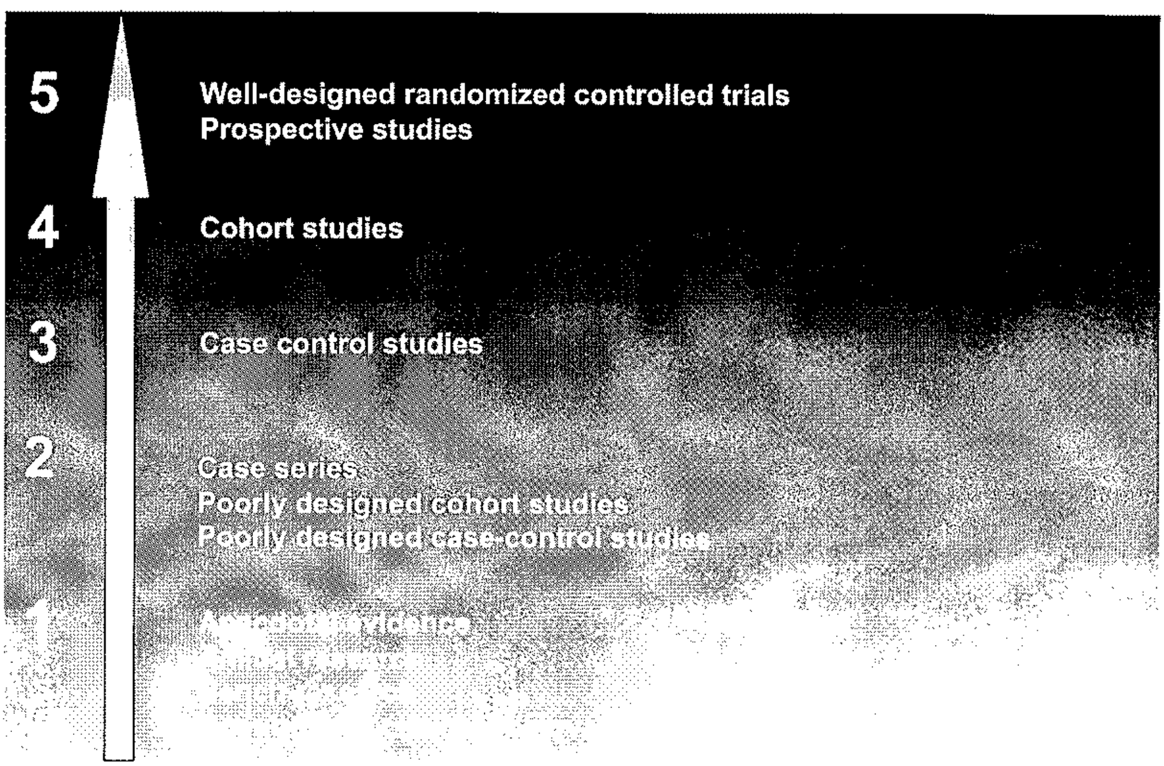
Steps to Evidence

- Ask focused questions.
- Find the evidence.
- Critically appraise.
- Make a decision.
- Evaluate performance

Ask focused questions.

Patient or Problem	Intervention	Comparison	Outcome
In non-adolescent patients with acute ankle trauma…	…who should get referred for radiographs…	…compared to who should not…	…to reduce the number of unnecessary x-rays and trips to the emergency room.

Levels of Evidence



Medina, 2006

*During Workshop presentation, the Levels of Evidence scale above was corrected with 1 being the highest level and 5 being the lowest level of evidence *original research*

Thermoregulatory Influence of a Cooling Vest on Hyperthermic Athletes

Rebecca M. Lopez, MS, ATC*; Michelle A. Cleary, PhD, ATC†; Leon C. Jones, MS, ATC‡; Ron E. Zuri, MS, ATC§

*University of Connecticut, Storrs, CT; †University of Hawaii, Honolulu, HI; ‡Lancaster High School, Lancaster, TX; §Broward Health, Coral Springs, FL

case report

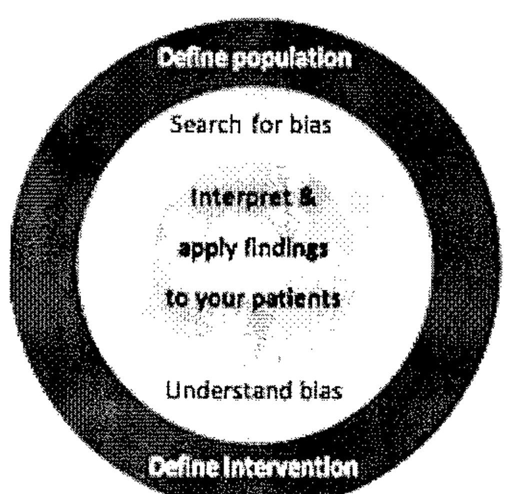
Rhabdomyolysis of the Deltoid Muscle in a Bodybuilder Using Anabolic-Androgenic Steroids: A Case Report

Uri Farkash, MD; Nogah Shabshin, MD; Moshe Pritsch (Perry), MD

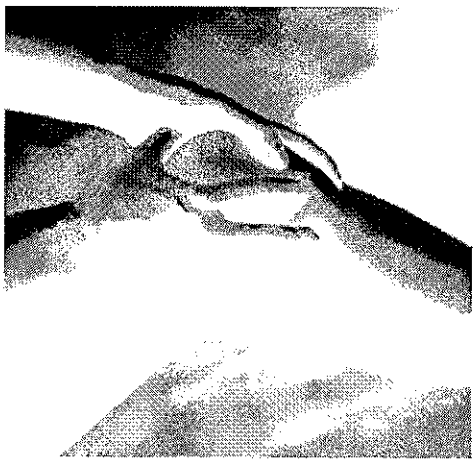
Sheba Medical Center, Tel Hashomer, Israel

Steps to Evidence

Make a decision.



Evidence in Diagnostics



Diagnostic Tests

- Reliability
- Validity
- Accuracy

Reliability

- Intra-rater reliability
- Inter-rater reliability

- Steps to enhance reliability?

Data Types

- Nominal (categorical; order of categories is arbitrary)
- Ordinal (categorical; logical ordering of categories)
- Interval (equal intervals; no absolute zero)
- Ratio (equal intervals; zero point)

Reliability Measures

- Intraclass Correlation (ICC)

  A measure of agreement between observers that can be used when your observations are scaled on an interval or ratio scale of measurement.
- Kappa statistic (κ)

  A measure of agreement for categorical data. Accounts for agreement that occurs by chance.

Reliability Measures (ICC & Kappa)

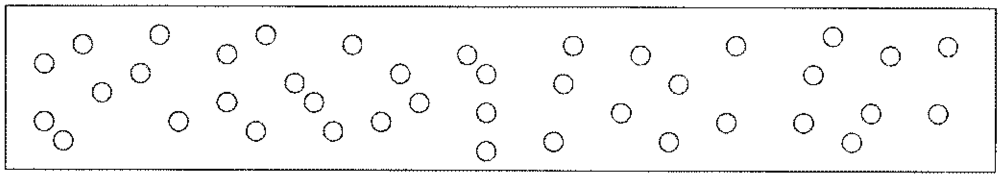
If the measure falls within this range…	…then the reliability is
<0.5	Poor
0.5 – 0.75	Moderate
>0.75	Good

Prevalence

- Extent to which a condition is present in a specific population.
- Changes based on group being studied.

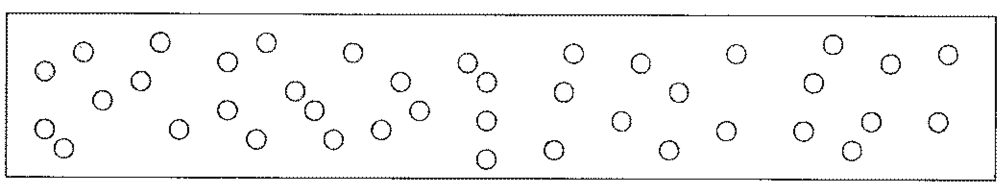
Pretest / Posttest Probability

- Pretest: Likelihood that a pt exhibits a specific disorder before the examination is performed. (Cleland, p. 3)
- Posttest: Likelihood that a pt exhibits a specific disorder after the examination is performed.



Clinical Test Positive	
Clinical Test Negative	

Grey dots = population of patients with knee pain



Red dots = pts w/ ACL sprains
Green dots = pts w/o ACL sprains

Clinical Test Positive	
Clinical Test Negative	

We perform a test and would like to think that it correctly categories each patient as either having the disorder or not.

	Reference Standard Positive	
Clinical Test Positive		
Clinical Test Negative		

We can compare our results against those of a gold (or reference) standard.

	Reference Standard Positive	
Clinical Test Positive		
Clinical Test Negative		

False positive result

False negative result

True positive result

Red = ACL sprain

	Arthroscopy Positive (n = 23)	
Costello Test Positive (n = 20)	17	3
Costello Test Negative (n = 20)	6	

Now let's see what happens when our findings are compared to the reference standard (in this case, arthroscopy).

Red = ACL sprain

	Arthroscopy Positive (n = 23)	
Costello Test Positive (n = 20)	a 17	b 3
Costello Test Negative (n = 20)	c 6	d

Accuracy = 100% x (a +   ) / (a + b + c +   )
= 100% x (17 +   ) / (17 + 3 + 6 +   )
= 78%

Positive and Negative Predictive Values (PPV and NPV)

- PPV = the value of the test in predicting a positive result
- NPV = the value of the test in predicting a negative result
- Problem: PPV+ heavily influenced by prevalence

Calculating Predictive Values

	Arthroscopy Positive (n = 20)	[illegible]	
Costello Test Positive (n = 20)	15 a	17,985 b	PPV = a / a+b = 15 / 18,000 = 0.08
Costello Test Negative (n = 20)	5 c	d	**NPV = c / c+d = 5 / 82,000 = 99.99**

Prevalence = 0.02% (20/100,000)

Prevalence = 20% (20,000/100,000)	Arthroscopy + (n = 20,000)		
Costello Test Positive	15,000 a	14,400 b	PPV = a / a+b = 15,000 /29,400 = 51.02
Costello Test Negative	5,000 c	d	NPV = c / c+d =5,000 / 70,600 = 92.92

Prevalence = 0.02% (20/100,000)	Arthroscopy + (n = 20)		
Costello Test Positive	15 a	17,985 b	PPV = a / a+b = 15 / 18,000 = 0.08
Costello Test Negative	5		NPV = c / c+d = 5 / 82,000 = 99.99
	c	d	

[redacted]

Sara's Mind Reading Positive (n =)	a	b
Sara's Mind Reading Negative (n =)	c	d

I believe that I can accurately identify your age based on your name. What should our gold standard be?

	Birth Certificate Evidence of Age Between 30 - 39 (n =)	
Sara's Mind Reading Positive (n =)	True positive a	False Positive b
Sara's Mind Reading Negative (n =)	False Negative c	d

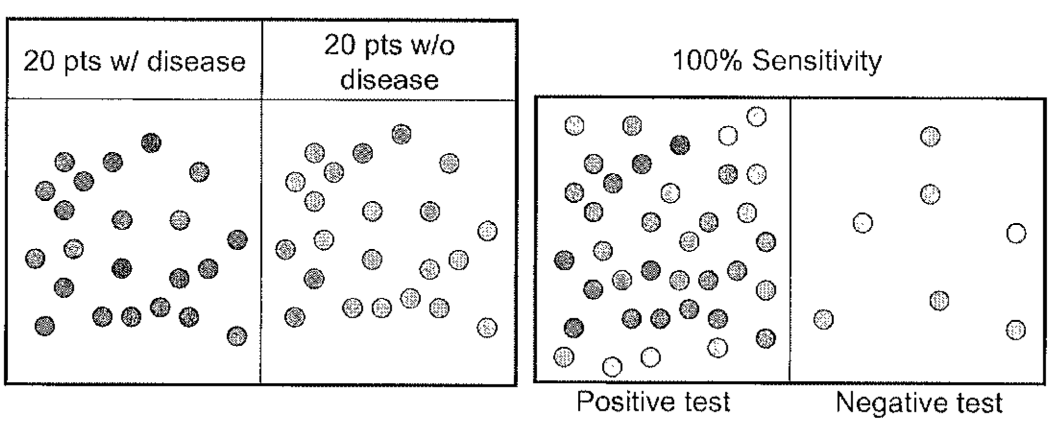
How did I do?

- True Positive: Correctly identified my age as between 30 - 39.
- [illegible]
- False Positive: Identified my age as between 30 - 39 and I am not in that age range.
- False Negative: Identified my age as NOT between 30 - 39 and I am between the ages of 30 - 39.

	Birth Certificate Evidence of Age Between 30 - 39 (n =)	
Sara's Mind Reading Positive (n =)	a	b
Sara's Mind Reading Negative (n =)	c	d

Sensitivity:

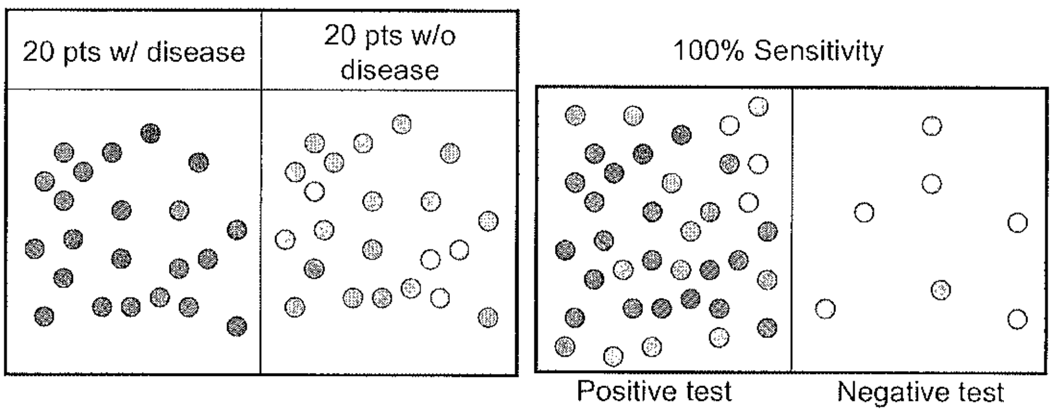
Test's ability to detect those patients who actually have the disorder, as compared to the reference standard.



With 100% sensitivity, everyone who has the condition will be identified.
But what's the problem with this?

Sensitivity:

Test's ability to detect those patients who actually have the disorder, as compared to the reference standard.



SnNout: The higher the e sitivity, the more likely that a egative finding rules the disorder.

Red = ACL sprain

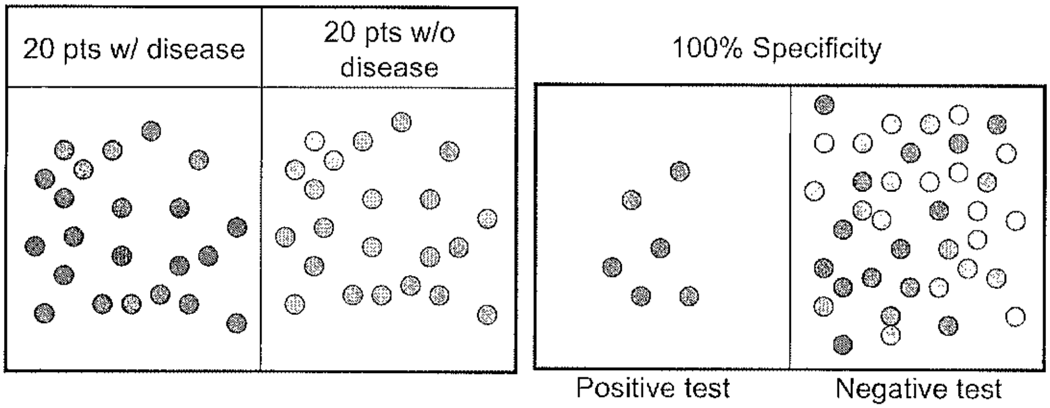
	Arthroscopy Positive (n = 23)	
Costello Test Positive (n = 20)	a 17	b 3
Costello Test Negative (n = 20)	c 6	d

Sensitivity = 100% x a/(a+c)

= 100% x 17/(17+6)
= 73%

Specificity:

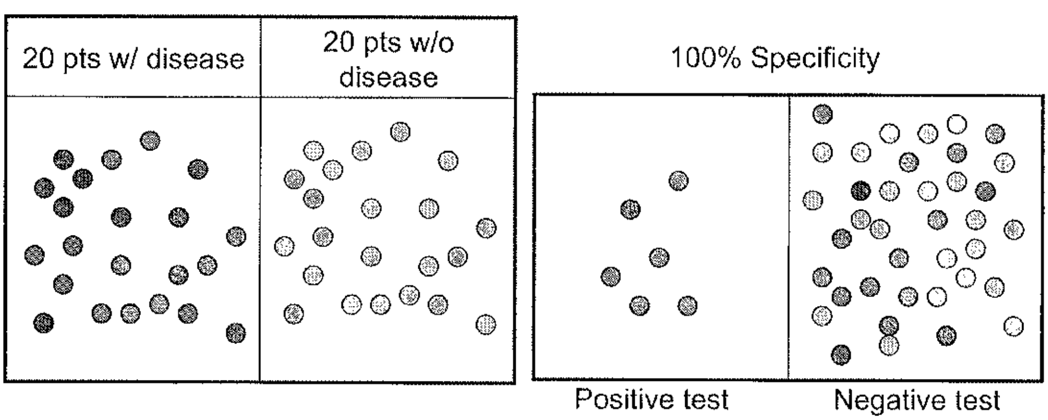
Test's ability to detect those patients who actually do not have the disorder, as compared to the reference standard.



With 100% specificity, a negative test will capture everyone who does not have the disease.

Specificity:

Test's ability to detect those patients who actually do not have the disorder, as compared to the reference standard.



SpPin: A test with a high specificity and a positive result is good for ruling in the disorder.

Red = ACL sprain

	Arthroscopy Positive (n = 23)	
Costello Test Positive (n = 20)	17 a	3 b
Costello Test Negative (n = 20)	6 c	d

Specificity = 100% x d/(d+b)
= 100% x 14/(14+3)
= 82%

	Birth Certificate Evidence of Age Between 30 - 39 (n =14)	
Sara's Mind Reading Positive (n = 6)	a	b
Sara's Mind Reading Negative (n =10)	c	d

Calculate sensitivity [= 100% x a/(a+c)]
Calculate specificity [= 100% x d/(d+b)]

Likelihood Ratio

- Test is valuable only if it changes the pretest probability that a patient has the disorder.
- LRs combine specificity and sensitivity to indicate a shift in probability.
- Positive LR = change in our confidence (shift in pre-test probability) that the condition is present based on a positive test
- Negative LR = change in our confidence (shift in pre-test probability) that the condition is present based on a negative test

	Birth Certificate Evidence of Age Between 30 - 39 (n =)	
Sara's Mind Reading Positive (n =)	a	b
Sara's Mind Reading Negative (n =)	c	d

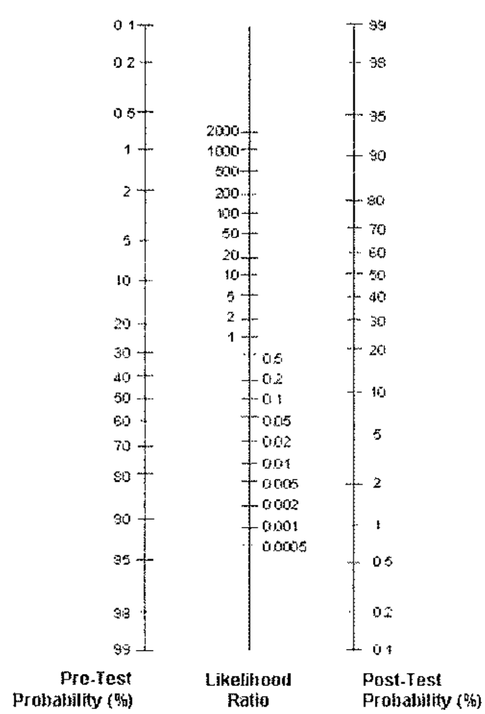
Calculate LR+:

	Birth Certificate Evidence of Age Between 30 - 39 (n =)	
Sara's Mind Reading Positive (n =)	a	b
Sara's Mind Reading Negative (n =)	c	d

Calculate LR-:

United States Census Bureau

30 - 39 years old = 13.7% of the population



Interpretation of Likelihood Ratios

Positive LR	Negative LR	Interpretation
> 10	< 0.1	Generate large and often conclusive shifts in probability
5 – 10	0.1 – 0.2	Generate moderate shifts in probability
2 – 5	0.2 – 0.5	Generate small but sometimes important shifts in probability
1 – 2	0.5 – 1	Alter probability to a small and rarely important degree

Cleland, 2005

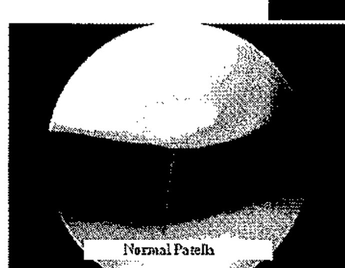
Clinical Practice: Clarke Sign

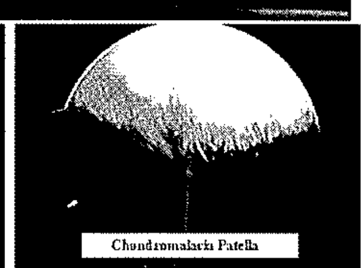
Sensitivity = 0.39

Specificity = 0.67

LR+ = 1.18

LR- = 0.91





JAT, 2008

Alter probability to a small and rarely important degree.	Generate small but sometimes important shifts in probability.	Generate moderate shifts in probability.	Generate large and often conclusive shifts in probability.
1 - 2	**2 - 5**	**5 - 10**	**>10**

Clarke Sign
(1.18)

Positive Likelihood Ratio: Extent to which positive findings changes probability that condition is present. The higher the number the greater the probability that the condition is present.

Alter probability to a small and rarely important degree.	Generate small but sometimes important shifts in probability.	Generate moderate shifts in probability.	Generate large and often conclusive shifts in probability.
0.5 - 1	**0.5 – 0.2**	**0.2 – 0.1**	**<0.1**

Clarke Sign
(0.91)

Negative Likelihood Ratio: Extent to which negative findings changes probability that condition is present. The smaller the number, the lower the probability that the condition is present.

APPENDIX G

Post-Workshop Letter of Instruction Sample

Dear ________________________________,

To begin, we would like to thank you for our attending our ATEC pre-conference workshop, *Evidence-Based Concepts for Clinical Practice Education: A Study Investigating the Effectiveness of a Single-Day Workshop*. As mentioned in previous emails as well as at the Educators' Conference, this study entails a pre- and post-workshop assessment.

As an attendee of this workshop, I would like to invite you to participate in the post-workshop survey assessment. The post-workshop online survey (link attached below) will take approximately 10-15 minutes to fill out and will need to be completed by March 20, 2009.

Information gathered from the post-workshop survey is vital to our study and we greatly appreciate your willingness to participate thus far. As always, if you have any questions or comments, please feel free to contact me at any time.

Thank you once again for your time,

Cailee Welch
Old Dominion University
cewelch@odu.edu

Link to Survey: https://periwinkle.ts.odu.edu/surveys/W5HE5T/

APPENDIX H

Breakdown of Statistical Tests Utilized

DATA ANALYSIS

Statistical Package for Social Sciences
(version 16.0, SPSS Inc. Chicago, IL)

Terminal Degree – Hours of Research – "Evidence-Based"-Related Workshops – Hours of Academic Coursework – Hours of Patient Care	
Knowledge	Composite: One-Way ANOVA
	Other: Repeated Measures ANOVA
Comfort	All: Mann-Whitney U Test
Importance	All: Mann-Whitney U Test

Years of Athletic Training Teaching Experience	
Knowledge	All: Pearson Product-Moment Correlation
Comfort	All: Spearman's Rank Correlation
Importance	All: Spearman's Rank Correlation

Effectiveness of a Single-Day Pilot Workshop	
Knowledge	All: Paired T-Test
Comfort	All: Wilcoxon Signed-Rank Test
Importance	All: Wilcoxon Signed-Rank Test

VITA

Cailee Elizabeth Welch

Department of Study

Old Dominion University
Department of ESPER
Student Recreation Center
Norfolk, VA 23529

Education

August 2009	Master of Science in Education, Athletic Training Old Dominion University Norfolk, Virginia
May 2007	Bachelor of Science, Athletic Training Boston University Boston, Massachusetts

Professional Experience

8/07 – 5/09

Old Dominion University; Norfolk, VA
Lab Instructor: Kinesiology & Human Anatomy (EXSC322, 4 cr.)
Instructor: Advanced First Aid and CPR (HE224, 3 cr.)
Instructor: Prevention & Care of Injuries (EXSC340, 3 cr.)

- Created lesson plans, skill laboratories, assignments, examinations, and practical examinations relating to pertinent course material
- Developed online-hybrid course utilizing various multimedia

8/07 – 7/08

Norfolk Public Schools – Powhatan Stadium; Norfolk, VA
Head Athletic Trainer

- Certified athletic trainer for high school football, field hockey, and soccer athletes, providing practice and game coverage
- Responsible for all on-field acute care as well created and supervised all functional return to play rehabilitation

7/08 – 8/09

Norfolk Collegiate School; Norfolk, VA
Head Athletic Trainer

- Certified athletic trainer for middle and high school athletes, providing practice and game coverage for all sports
- Performed daily evaluations of athletic injuries, created and supervised treatment and rehabilitation protocols for athletes, and maintained all administrative and budgetary duties

Publications

2008 **Welch CE**, Yakuboff MK, Madden MJ
Athletic Therapy Today – pp. 10-12 Volume 13(5)
Critically Appraised Papers and Topics Part 1: Use in Clinical Practice

2008 **Welch CE**, Yakuboff MK, Madden MJ
Athletic Therapy Today – pp. 13-16 Volume 13(5)
Critically Appraised Papers and Topics Part 2: How to Read and Interpret a CAP

2007 **Welch CE**, Lam KC, Laursen RM
Journal of Athletic Training – pp. S113 Volume 42(2) Supplement
Paget-Von Schrötter Syndrome in a Non-Dominant Arm: A Case Report

Presentations

2008 **Welch CE**, Van Lunen BL, Onate JA
Usefulness of Critically Appraised Papers & Topics Within Your Clinical Practice
Mid-Atlantic Athletic Trainers Association Symposium
Virginia Beach, VA

2007 **Welch CE**, Van Lunen BL, Onate JA
Paget-Von Schrötter Syndrome in a Non-Dominant Arm: A Case Report
SEATA Athletic Training Student Symposium
Atlanta, GA