KNOWLEDGE, USE, AND PERCEPTIONS OF FUNCTIONAL MOVEMENT SCREENING TOOLS AMONG CERTIFIED ATHLETIC TRAINERS

A THESIS

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THESIS APPROVAL

Graduate Athletic Training Education

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INTRODUCTION

Injury prevention is one of the domains of athletic training, along with clinical evaluation, diagnosis, immediate emergency care, and rehabilitation. It can be argued that injury prevention may be the most important of all the domains of athletic training. High school athletes alone account for approximately 2 million injuries, 500,000 doctors visits, and 30,000 hospitalizations annually.[1] Multiple factors have been identified in the published literature that identify risk factors that increase likelihood of injury in athletes, including previous injury, muscle flexibility, asymmetry, poor lower extremity biomechanics, dysfunctional movement patterns, and unilateral balance deficits.[2-7] It is important to identify and correct these factors because research has shown that upwards of 30% of musculoskeletal injuries seen in athletics are muscle strains.[8]

The use of functional movement screening tools can identify these muscular imbalances and suggest what type of strengthening, proprioception activity, muscle activation, or stretching the individual should perform in order to possibly prevent occurrence of injury.[9-16]

There are many different types of functional movement screenings, but the ones that will be focused on in this study are the Functional Movement Screen, Selective Functional Movement Assessment, Y-balance Test, and Star Excursion Balance Test. Each of these functional movement screening tools have been shown to have good interrater reliability,[7,17-22] as well as the ability to identify individuals who are at greater risk of injury.[9-15,23] Research shows that a functional movement screening tool can be a useful tool in athletic training practices. However, there has been no published research regarding the usage of movement screenings in clinical practice by certified athletic trainers.

The goal of this study will be to determine the rate of athletic trainers using functional movement screenings, along with their knowledge and perceptions the subject of these screenings.

METHODS

The primary purpose of this study was to examine the knowledge of functional movement screening tools among certified athletic trainers, as well as their perceptions and rates of usage of these tools through survey research. This section will include the following: participants, instrumentation, procedures, hypotheses, and data analysis.

Participants

The participants of this study were a randomized sample of 1,000 athletic trainers who are active certified or career starter members of the National Athletic Trainers' Association (NATA). Of the 1,000 that received the survey, 152 completed the survey.

Instrumentation

The instrument used in this study was a survey created on surveymonkey.com by the principal researcher and one other certified athletic trainer. A panel of experts was utilized to review the survey (see Appendix C). The survey included questions inquiring about participants use, knowledge, and perceptions of a functional movement

screening tool. Demographics were also collected in the survey including age, years of experience as a certified athletic trainer, setting of the participants' practice, and sex of the participants.

In addition to the panel of experts review, a pilot study was conducted with four athletic training staff members and 19 graduate assistant athletic trainers at a small university in the northeast United States. This pilot study allowed the researcher to correct survey errors, grammar, and determine the length of time necessary to complete the survey. No changes were made as a result of the pilot survey.

Procedures

Before administering the survey, the Institutional Review Board at California University of Pennsylvania approved the procedures of this study. Participation in the study was completely voluntary.

The survey was distributed to athletic trainers who were active members of the NATA in the following membership categories: certified member, certified student. The NATA membership office randomly selected 1,000 members meeting the above criteria and distributed the researcher's survey

cover letter containing the link of the survey. The survey cover letter stated that by clicking the link, the recipient was indicating their willingness to participate (see Appendix C1).

Participants were able to discontinue their participation at any point in time. It took approximately 10 minutes to complete the survey. Following the final question, the participants were thanked for their participation.

Hypotheses

1. Less than 30% of athletic trainers surveyed will use at least one functional movement screening tool.
2. More than 75% of athletic trainers surveyed will perceive functional movement screening tools as at least "somewhat useful" on a Likert Scale.
3. Athletic trainers with more years of experience will be more likely to correctly answer knowledge questions than athletic trainers with less years of experience.

Data Analysis

All data was analyzed by SPSS version 22.0. Descriptive statistics were used to determine percentages and frequencies of the demographic data, as well as percentages and frequencies of functional movement screening tool use, knowledge, and perceptions. T-tests were used to compare differences in functional movement screening tool use, knowledge, and perceptions and various demographics including age, years of experience as a certified athletic trainer, and employment setting.

RESULTS

The purpose of this study was to examine the knowledge of functional movement screenings among certified athletic trainers, as well as their perceptions and rates of usage of these tools through survey research.

Participant Demographics

Out of a total 1,000 surveys distributed to NATA member certified athletic trainers, a total of 152 participants completed the survey, resulting in a 15.2% response rate. The demographics of the participants are shown in Tables 1 though 5.

Table 1. Age Range of Participants

Age Range	N	Frequency (%)
20-30	61	40.13%
31-40	40	26.32%
41-50	35	23.03%
51-60	12	7.89%
61+	4	2.63%
Total	152	100%

Table 2. Sex of Participants

Sex	N	Frequency (%)
Male	67	44.08%
Female	85	55.92%
Total	**152**	**100%**

Table 3. Years of Experience

Years of experience as an ATC	N	Frequency (%)
0 - 2	18	11.84%
3 - 10	62	40.79%
11 - 15	17	11.18%
16 - 20	20	13.16%
21+	35	23.03%
Total	**152**	**100%**

Table 4. Work Settings

Work Setting	N	Frequency (%)
High School	47	30.92%
College	55	36.18%
Professional	3	1.97%
Other	47	30.92%
Total	**152**	**100%**

Table 5. NATA District

NATA District	N	Frequency (%)
1 - CT, ME, MA, NH, RI, VT	12	7.89%
2 - DE, NJ, NY, PA	17	11.18%
3 - MD, NC, SC, WV, VA, DC	10	6.58%
4 - IL, IN, MI, MN, OH, WI	42	27.63%
5 - IA, KS, MO, OK, ND, SD, NE	23	15.13%
6 - AR, TX	10	6.58%
7 - AZ, CO, NM, UT, WY	7	4.61%
8 - CA, HI, NV	6	3.95%
9 - AL, FL, GA, KY, LA, MS, TN	18	11.84%
10 - AK, ID, MT, OR, WA	7	4.61%
Total	**152**	**100%**

Hypothesis 1: Less than 30% of athletic trainers surveyed will use at least one functional movement screening tool.

Using descriptive statistics, it was found that 48.68% (n=74) of participants administered at least one type of functional movement screening tool. Therefore, hypothesis 1 was rejected.

Hypothesis 2: More than 75% of athletic trainers surveyed will perceive functional movement screening tools as at least "somewhat useful" on a Likert Scale.

Using descriptive statistics, it was found that 78.33% (n=57) of participants perceived functional movement screening tools as at least "somewhat useful." Therefore, hypothesis 2 was failed to be rejected.

Hypothesis 3: Athletic trainers with more years of experience will be more likely to correctly answer knowledge questions than athletic trainers with less years of experience.

A one way ANOVA was conducted to compare mean total knowledge scores between years of experience groups. Total knowledge scores were calculated by scoring 1 point for each correct response. There were a total of 3 knowledge questions. Total knowledge scores were attained. Hypothesis 3 was rejected as there was no significant difference found between years of experience and knowledge scores (df=4, mean square=.488, p=0.326).

Additional Findings

The most commonly used functional movement screening tool was the Functional Movement Screen and the least commonly used was the Y-balance test (Table 6).

Participants were able to select all of the screenings that they utilize.

Table 6. Functional Movement Screening Tools Usage

Functional Movement Screening Tool Used	**N**	**Frequency (%)**
Functional Movement Screen	48	31.58%
Selective Functional Movement Assessment	25	16.45%
Generic screen of functional movements created by sports medicine staff	20	13.16%
Star Excursion Balance Test	17	11.18%
Y Balance Test	14	9.21%
Other	9	5.92%
No functional movement screening tool	78	51.32%

One hundred and six (69.74%) participants knew an athletic trainer who used a functional movement screening tool in their practice, while 46 (30.26%) did not.

The most common time the screening tools were being administered in practice were pre-season and before return to activity. Of 68 participants, 55.88% (n=38) were able to screen between 0-50 patients in the pre-season, 1.47% (n=1) were able to screen 101-150, 1.47% (n=1) were able to screen 151-200, 2.94% (n=2) were able to screen more than

200, and 38.24% (n=26) did not administer a functional movement screening tool during preseason.

Out of 68 participants who use functional movement screening tools, 16 (23.53%) participants had less than a year of experience using functional movement screening tools, 43 (63.24%) had 1-5 years of experience, 7 (10.29%) had 6-10 years of experience, and 2 (2.94%) had more 11 or more years of experience. The most common functional movement used when administering a functional movement screening tool was the over-head deep squat, and the least common was the pistol squat (Table 7). Participants were able to choose all of the movements they utilize and were not limited to only one answer.

Of 62 participants, 82.2% (n=50) use an individualized correction program, 8.06% (n=5) use a group correction program, 3.23 use no type of corrective intervention, and 6.46% (n=4) use both an individual and group correction program. Thirty five (56.45%) participants record and save data to examine changes in injury rates among patients, while 27 (43.55%) do not. Of the 35 participants who do record data, 14.29% (n=5) reported that the data has shown a significant decline in injury rates, 25.71% (n=9)reported

Table 7. Functional Movements Used

Functional Movements Used When Administering Screening	N	Frequency (%)
Overhead Deep Squat	54	87.10%
Active Straight Leg Raise	45	72.58%
Shoulder Mobility	43	69.35%
Inline Lunge	42	67.74%
Trunk Stability Push Up	35	56.45%
Hurdle Step	34	54.85%
Rotary Stability	33	53.23%
Pistol Squat	7	11.29%
Other	10	16.13%

that the data has shown a slight decline, 5.71% (n=2) reported that the data has shown no decline in injury rate, and 54.29% (n=19) have not analyzed their data or are unsure of any changes in injury rate. Twenty (32.79%) participants only administer upper or lower extremity intensive screenings based on the specific activity or sport of the athlete they are screening, while 41 (67.21%) administer both upper and lower extremity intensive screenings regardless of sport.

Of 61 participants who use functional movement screening tools, 37.7% (n=23) are very confident in administering the screening, 39.34% (n=24) are somewhat

confident in administering the screening, and 22.95% (n=14) are neutral in administering the screening. None reported a lower confidence level than neutral. Of 60 participants who administer functional movement screenings, 33 (55%) reported encountering no problems. Twenty seven (45%) reported various problems, with time restraint being the most common.

Of 133 participants, 31 (23.31%) correctly knew the cut off score on the Functional Movement Screening that determines when an athlete is more susceptible to injury, 18 (13.54%) answered incorrectly, and 84 (63.16%) were unsure or unaware.

One hundred and twenty eight participants were asked if they knew how little of a reach difference on the Star Excursion Balance Test can predispose an athlete to a greater risk of injury, 10.16% (n=13) correctly answered 4 centimeters, 9.38% (n=12) answered incorrectly, and 80.47% (n=103) were unsure or unaware. These same participants were asked if they knew which direction of the Star Excursion Balance Test is more predictive of dynamic balance impairments in patients with chronic ankle instability. The correct answer, posteromedial, was selected by 5 (3.91%) participants. Twenty (15.63%)

participants answered incorrectly, and 103 (80.47%) were unsure or unaware.

Out of 68 participants who use functional movement screening tools, 6 (8.82%) participants are conducting research.

Since using functional movement screening tools, 7 (11.48%) participants have perceived a significant decline in injury rates, 22 (36.07%) have perceived a small decline in injury rates, 6 (9.84%) have perceived no change in injury rates, and 26 (42.62%) are unaware of any changes in injury rate.

Of 61 participants who administer functional movement screening tools, 33.33% (n=20) believe that educational information of these tools is covered sufficiently at national, regional, and state symposiums while 66.67% (n=40) do not. One hundred thirty four participants were asked if they would attend a workshop on how to administer a functional movement screening tool at their national, regional, or state symposium. Of these 134, 115 (85.82%) answered that they would attend such a workshop.

Of 60 participants who administer functional movement screenings, 23 (38.33%) participants felt that functional movement screening tools were very useful, 24 (40%) felt the tools were somewhat useful, 10 (16.67%) were neutral,

and 3 (5%) felt that the tools were not very useful. No participants felt that the tools were not useful at all.

Discussion

The purpose of this research was to examine the frequency of functional movement screening tool usage among athletic trainers, as well as their perceptions and knowledge of the tools. The following section is divided into five subsections: Functional Movement Screening Tool Usage, Functional Movement Screening Tool Perceptions, Functional Movement Screening Tool Knowledge, Conclusions, and Recommendations.

Functional Movement Screening Tool Usage

The results of the survey showed almost an even 50/50 split of functional movement screening tool usage among athletic trainers. That was a much higher rate of usage than originally hypothesized. Table 8 shows that the age ranges most likely to utilize functional movement screening tools were the 41-50 and 51-60 age ranges. Due to a small sample size, the rates may not be reflective of all athletic trainers. However, the athletic trainers that fall within this age range may be more likely to go to athletic training symposiums and conventions, as well as read academic journals, which could be the reason behind their higher rates of usage as compared to the younger population of athletic trainers.

Table 8. Age Range of Participants and Usage Rate

Age Range	Use	Do Not Use	Usage Rate (%)
20-30	27	34	44.26%
31-40	20	20	50.00%
41-50	19	16	54.29%
51-60	7	5	58.33%
61+	1	3	25.00%
Total	74	78	48.68%

Fifty-nine (86.77%) athletic trainers who do use functional movement screening tools, have been using them for only 5 years or less. This shows that usage of these tools is relatively new for athletic trainers.

Of the athletic trainers that use functional movement screening tools, only 8.82% (n=6) are conducting research on the tools. Further research on the tools and their effectiveness to prevent injuries can be the key in increasing rates of usage among athletic trainers.

When asked if educational information on functional movement screening tools is covered sufficiently at national, regional, or state symposiums, exactly two thirds of athletic trainers felt that it was not. Additionally, 87% of athletic trainers stated that they would attend a workshop on how to administer a functional movement

screening tool at these national, regional, or state meetings. This shows that the interest in functional movement screening tools is present in athletic trainers, but the research and workshops are not.

When athletic trainers who do not use functional movement screening tools were asked why they do not use the tools, lack of time (47.3%) and lack of knowledge (41.89%) made up almost 90% of the answers. Athletic trainers that do use functional movement screenings were asked what type of problems they most commonly encounter. Time restraint was the most common answer. Other answers included problems with scoring and the equipment required to perform the screening.

The lack of knowledge can be addressed by having more educational workshops on how to administer the tools at conferences. Time needed to administer a functional movement screening can be minimized with increased usage of the tools. As an athletic trainer increases his or her experience with using the tools, they can become sharper on what movement patterns they are looking for, which in turn can lessen the time needed for each individual patient's screening.

Functional Movement Screening Tool Perceptions

Athletic trainers that use functional movement screening tools were asked how useful they felt the tools were in their clinical practice. None felt that the tools were not useful at all, and only 3 (5%) participants felt that the tools were not very useful. The other 95% of participants were either neutral, or perceived the tools as somewhat to very useful. Of the athletic trainers that use the tools, only 6 (9.84%) did not perceive a decline in injury rates.

Thirty-five athletic trainers recorded data with the functional movement screen usage. Of the 35, only 2 responded that the data has shown no decline in injury rates. With such positive perceptions, and data showing that the tools can lead to a decline in injury rates, it is surprising that more athletic trainers are not using these tools.

Functional Movement Screening Tool Knowledge

The knowledge question with the highest correct response rate was the Functional Movement Screen cutoff score that determines whether an individual is more likely to sustain an injury. Thirty-one (23.31%) participants answered the question correctly. The Star Excursion Balance Test knowledge questions had a much lower correct response

rate of 10.16% and 3.91%. This may be due to the higher usage rates of Functional Movement Screen compared to the Star Excursion Balance Test, as 31.58% of participants use the FMS, while only 16.45% of participants use the Star Excursion Balance Test. Increased rates of functional movement screening tool usage among athletic trainers can lead to higher knowledge rates regarding the research on these tools, because athletic trainers that do not use the screenings that were on the survey, would likely not have much knowledge on them.

Increased exposure and education on functional movement screening tools can positively affect usage rates and knowledge alike. If these tools were covered more extensively at athletic training conventions and symposiums, more athletic trainers would understand the usefulness of the tools, which could lead to increased usage.

Conclusions

The results of the survey revealed that:

1. Athletic trainers generally view functional movement screening tools as useful and effective, despite only about half of athletic trainers utilizing these tools.
2. Knowledge levels of the most recent research regarding functional movement screening tools were relatively low, regardless of whether the athletic trainer used the tools themselves or not.
3. Perceptions of the usefulness of these tools were positive.

Increased usage of functional movement screening tools can directly increase knowledge and perceptions of the tools. A large majority of athletic trainers answered in the survey that they felt workshops and symposiums were not covering the tools enough, and that they would be interested in attending these workshops if they did cover that material. Therefore, that may be the first step in increasing usage rate and knowledge of functional movement screening tools.

Recommendations

To the researcher's knowledge, there has been no published research on usage, perceptions, or knowledge of functional movement screening tools. The survey results showed that the most common reason athletic trainers are

not using functional movement screening tools is inadequate time. Future research studies should examine whether there is a way to possibly condense the movement screenings into a shorter amount of time to be more time efficient. Perhaps a shorter, but just as effective, functional movement screening can increase rates of usage among athletic trainers.

The survey results also showed that most athletic trainers are implementing either an individualized or group intervention program to correct the muscle imbalances found with the functional movement screening tool. Future research studies should examine whether an individualized intervention program is more effective than a group program, and if so, how much more, or less, effective one is compared to the other.

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APPENDIX A

REVIEW OF LITERATURE

Review of Literature

Along with clinical evaluation, diagnosis, immediate emergency care, and rehabilitation, injury prevention is one of the domains of athletic training. As athletic trainers, are we doing all that we can to ensure the maximum prevention of injuries for our patients? There are multiple factors that can add to the risk of injury, with muscular tightness and under-activity as common factors that can lead to injury in the active population. The use of functional movement screenings can identify these muscular imbalances and dictate what type of strengthening or stretching one should do in order to possibly prevent the onset of injury. However, there has been no research on the usage or perceptions of these functional movement screening tools.

There are many different ways to injure muscles, ranging from contusions to lacerations. However, the most common injury to muscle is a strain, which can account for upwards of 30% of musculoskeletal injuries seen in athletics.[1] Some researchers have indicated that muscle injuries are caused by multiple factors. These factors that influence muscle strains can be either intrinsic or extrinsic. Extrinsic factors include environmental

conditions while intrinsic factors would include things such as muscular weakness, lack of muscular flexibility, and strength imbalance.[2,3]

This framework has allowed researchers to examine intrinsic factors for muscular injury. Researchers have found that the most common intrinsic risk factors for injury in high school and college football players are previous history of injury,[4] muscular flexibility,[5] laxity of ligaments,[6] body composition,[7] and core stability.[8,9] According to a study done by Orchard,[10] intrinsic factors are a much better predictor of muscular strain than extrinsic factors. To prevent muscle strains due to intrinsic factors such as strength imbalances, one must first understand the significance of muscle imbalance.

Muscle Imbalance

The definition of a muscular imbalance is a "modification of the strength balance between the agonist and antagonist muscles."[2] The reason it is important for agonist and antagonist muscle strengths to be close to balanced is because the antagonist muscle must contract eccentrically when the agonist muscle concentrically contracts to decelerate the force being applied to the limb.[2] For example, when a soccer ball is kicked, the

quadriceps' concentric contraction must be counteracted by the hamstrings' eccentric contraction to avoid hyper-extension of the knee. If the strength differences are significant enough, it can predispose an athlete to injury.

However, muscular imbalance does not only account for unilateral comparison. Bilateral comparison also accounts for muscular imbalances.[2] Hamstrings, when bilaterally compared, should have no more of a 15% deficit in strength. Any more than 15% strength deficit on bilateral comparison would be classified as a muscle imbalance. However, some clinicians go as low as 10% deficit for their criteria of a strength imbalance.[2] These strength measures are attained through isokinetic testing. Isokinetic translates to "same speed", which perfectly describes how an isokinetic machine works. Muscles contract at a constant speed, such as 180 degrees per second for example, and the resistance to the machine's force is measured throughout the range of motion.

Isokinetic testing is often the preferred measure for strength testing because it gives concrete, numerical values to an athletes' strength and strength ratios. However, it is very expensive to purchase or obtain an isokinetic machine, as well as time consuming to run tests on. Another potential method to test muscular imbalance is a functional movement screening. With someone that knows

how to explain the screening to their subject and know what to look for, functional movement screenings are much quicker than isokinetic testing, inexpensive, and can still identify over- and under-active muscles.

Muscle Imbalance and Injury

According to Crosier,[2] the muscles that are most commonly injured and re-injured due to a muscular imbalance are the hamstring group. Croisier believes that re-injury is so common in the hamstrings because there is an initial muscle imbalance between quadriceps and hamstring strength, leading to the initial strain. However, once the athlete exhibits pain-free range of motion and the ability to sprint and participate in their sport, they return prematurely. Rather than rehabilitating and getting their hamstring to quadriceps strength ratio to the acceptable 60%, the athlete participates with a muscular imbalance again and eventually re-injures the muscle, leading to a vicious cycle.

In a study conducted by Croiser,[2] 26 athletes with previous history of hamstring strains were tested isokinetically. Of the 26 subjects, 18(69%) of them fell into the category of muscular imbalance. Taking these 18 muscularly imbalanced subjects, rehabilitation was carried

out until all of the subjects had acceptable strength ratios. These subjects were then followed up for 12 months after their return to activity. For the 12 months that followed, none of the subjects reported a re-injured hamstring or any discomfort.

In a separate study by Tyler et al,[11] preseason testing was done on the hip strength of professional ice hockey players to see if that would be an indicator of adductor and hip flexor strains. Adductor strength was found to be 18% lower in players that suffered adductor strains when compared to the non-injured players. The non-injured players had adductor strength that was roughly 95% of their abductor strength, where the injured players had only 78% adduction strength when compared to their abductors. Tyler et al[11] concluded that athletes with less than an 80% adductor to abductor strength ratio were 17 times more likely to strain their adductor muscle group.

Yeung et al[12] followed 44 sprinters sprinters from the Hong Kong Sports Institute during the length of a season after a preseason isokinetic strength screening at 180 degrees per second. The sprinters were instructed to report any injuries that occurred from practice or meets. Over the course of the season, 8 sprinters reported hamstring strains. All of the injured athletes had hamstring to

quadriceps strength ratios of less than the balanced 60%. Yeung et al[12] concluded that athletes with less than 60% ratio at a velocity of 180 degrees per second were 17 times more likely to sustain a hamstring strain.

Muscle imbalances are not limited to only causing acute injuries. In a study by Devan et al,[13] 53 NCAA Division I female athletes (23 field hockey, 20 soccer, 10 basketball) underwent pre-season isokinetic testing at 60 and 300 degrees per second, testing hamstring to quadriceps strength ratio. Genu recurvatum and Q-angles greater than 18 degrees were also recorded. The Ober test was used to assess the flexibility of the Iliotibial band. After the seasons were concluded, 9 subjects suffered 10 overuse injuries to their knees. There were 5 I.T. Band friction syndromes, 3 patellar tendinitis, 3 patellafemoral syndromes, and 1 pes anserine tendinitis. All athletes that recorded normal ranges for their hamstring to quadriceps strength ratio did not experience overuse knee injuries. All 9 of the injured athletes had below normal ranges for their strength ratio. Also, all athletes that were recorded to have genu recurvatum had hamstring to quadriceps ratios that fell below the acceptable ranges. Hewett et al[14] states that determining what individuals are at risk for injury is a very difficult task due to each individual being

different, but the Functional Movement Screening may be an answer to that problem.

Functional Movement Screenings as an Injury Prevention Tool

The Functional Movement Screen is a means to which one can assess range of motion, coordination, flexibility, strength, balance, and proprioception in a subject.[15] The FMS is able to identity weaknesses in proprioception, stability, and mobility.[15-22] The 7 different tests that comprise the FMS are: deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise, trunk stability push up, and rotary stability.[22] Each of the screenings tests different muscles for strength imbalances and under/over-activity.

Researchers such as Pilsky et al[16] hypothesized that pre-participation physical examinations that synchronously assess different aspects of function, such as range of motion, balance, and strength, can be used to accurately identify at-risk athletes. Other researchers have studied the effectiveness of the functional movement screening and its value as an injury predictor. Previous history of injury has been determined to be the best predictor of injuries in athletes.[24-28] History of injury cannot specifically be changed by a person, but the residing

effects of the injury such as asymmetrical motor patterns can be.

Kiesel et al[17] performed a study with a professional football team during the preseason. Kiesel, along with his fellow researchers, had a whole professional football roster undergo all 7 functional movement screenings before the preseason began. Preseason injuries were noted and FMS scores were compared amongst the athletes that sustained injuries during preseason. It was found that a FMS score of 14 or less was indicative of an athlete that was more prone to injury than an athlete that scored above 14. The study revealed an odds ratio of 11.67, which meant that a player with an FMS score of less than 14 was 11.67 times more likely to sustain an injury than a player that scored above 14. The post-test probability was found to be 0.51. With a pre-test probability of 0.15, the study revealed that players with scores of 14 or less increased their chances of sustaining an injury from 15% to 51%. However, this study by Kiesel et al. simply looked at the FMS score and purposely ignored asymmetries amongst the subjects.

Kiesel et al,[22] with a slightly different team of researchers, conducted another study dealing with professional preseason football and a pre-participation functional movement screening. Once again, players

underwent an FMS before participation, but this time asymmetries amongst the participants were also taken into account, as well as the FMS score of the individual. Injuries during pre-season were then noted and compared to pre-season FMS scores and asymmetries. The results of the research confirmed that an FMS score of 14 was the threshold for whether an individual was more at risk to sustain injury. Adding to that, the research also found that regardless of FMS score, patients with at least 1 asymmetry were also more at risk for sustaining an injury. The asymmetries were speculated to be due to motor-control deficiencies, which have been shown to have a negative effect on cutting and other quick changes of direction.[29] The study concluded that the athletes most at risk were those with an FMS score of less than 14 *and* movement asymmetries present, with a .87 specificity for injury.

Changing gears from professional football players, Chorba et al[29] performed a research study to see if FMS could correctly predict injury risk in female collegiate athletes. The subjects were 38 Division II athletes, participating in soccer, volleyball, and basketball. Functional movement screening scores were calculated before the start of participation and injuries sustained were recorded. The study found that, like the previous research

studies mentioned, a score of 14 or less on a FMS represented an increased risk of injury for the athlete. Of the athletes that scored 14 or less, 69% of them sustained an injury during the season.

Other studies have also shown that the functional movement screening can identify individuals at risk for injury, but differ in their score that categorizes a person as "at risk." Letafatkar et al[30] took 50 active females and 50 active males between 18 and 25 years old with no muscle injuries in the previous 6 weeks. These participants were active in handball, soccer, and basketball and participated in the sport regularly (more than 1.5 hours a week) for at least 3 years. Injuries were noted and the research showed that subjects that scored less than a 17 on their FMS were more at risk to be injured. This differs from the score of 14 that was determined in the previous studies. However, the participants in the previous studies were performing in their respective sports at much more than the 1.5 hours a week that was a cut-off for Letafatkar et al's study.

Inter- and Intrarater Reliability of the Functional Movement Screen

With increasing use of functional movement screenings comes the question of whether one rater's score will be

similar to that of another rater's score. Along with interrater reliability, the consistency of a rater's score when repeating the screening with the same subject, also known as intrarater reliability, is also an important aspect of being able to successfully administer a satisfactory screening.

Multiple studies have shown that total scores between raters of varying FMS experience have been reliable.[32,33] One study by Gulgin et al[9] consisted of having an expert(3 years of FMS experience as well as formal FMS training) and 3 novices(third year physical therapy students) independently score 20 healthy college students and compare scores to test for consistency. The total mean scores by all of the raters showed no significant difference. The mean score of the expert rater was slightly lower than those of the novices, but the difference was not a significant value.

Another study by Smith et al[32] also consisted of 4 raters of varying expertise: 2 physical therapy students, an athletic trainer, and a certified FMS rater. The subjects included 10 healthy men and 9 healthy women from the university's physical therapy program. The subjects were rated a total of 2 times, one week apart, by each of the raters. Along with interrater reliability being shown to be consistent in both of the sessions, three of the

clearing tests also had a 100% agreement between all of the raters.

When considering test-retest scores, or intrarater reliability, studies have also shown favorable results.[32,33] Smith et al[32] also examined the intrarater reliability with the 4 raters of varying expertise and found that all 4 had an intraclass correlation of at least 0.81.

Gribble et al[33] conducted a study in which 38 participants volunteered to score 3 individuals that were filmed performing the 7 FMS movements. The 38 individuals were broken into 3 groups: athletic training students, athletic trainers, and athletic trainers with at least 6 months experience of administering functional movement screenings. The 3 videos were all scored by the participants. One week later, the order of the videos was randomized and the raters were asked to score them again. The results showed that intrarater reliability was strongest with the athletic trainers with at least 6 months experience, which had an intraclass correlation of 0.946, and poorest with the athletic training students, which had an intraclass correlation of 0.372. Therefore, intrarater reliability may be stronger with more experienced raters as opposed to those with little to no experience administering a functional movement screening.

Y-Balance Test as an Injury Predictor

The Y-balance test is a functional movement screening tool that tests the dynamic balance of the participant. While the patient is balancing on one leg, their contralateral leg reaches out in the anterior, posteromedial, and posterolateral directions as far as they can while maintaining balance. The distance reached is then recorded and this process is repeated with the opposite leg.

Smith et al[34] conducted a study in which 184 NCAA Division I athletes completed the Y-balance test during their preparticipation examination. Their scores and bilateral asymmetries were recorded. The participants were then monitored during the season for any noncontact injuries that required the aid of the athletic training staff. Once all of the participants had finished their athletic seasons, scores and asymmetries were compared between the injured group and the non-injured group. Smith et al found that participants with asymmetrical anterior reach differences of 4 centimeters or greater had a 220% chance of sustaining a non-contact injury compared to participants with anterior reach asymmetries less than 4 centimeters.

This finding supported the research of Plisky et al[35] which found the same 4 centimeter cut-off associated with anterior reach asymmetries, leading to a 250% increase in injury susceptibility. This same study by Plisky et al also found that female athletes with a composite reaching distance that did not exceed 94% of their lower limb length are 6.5 times more likely to sustain a lower extremity injury.[35]

A research study by Noronha et al[36] had 121 participants undergo a set of tests, including the Y-balance test, which tested ankle stability. These 121 participants underwent the tests and were followed up for 52 weeks. After the 52 weeks passed, the participants were categorized into either a group that sustained ankle sprains or a group that did not. The study found that there was a 48% higher risk of sustaining an ankle sprain in participants that had less than 80 centimeters of reach in the posterolateral direction. Participants that exceeded 90% of lower limb length for their posterolateral composite score had a significantly lower rate of sprains.

Inter- and Intrarater Reliability of the Y-Balance Test

In the early stages of the Y-balance test being developed, Plisky et al[37] had 15 male collegiate soccer players undergo the Y-balance test to report the development of this test, as well as examine the interrater and intrarater reliability of the test. The 15 participants were all directed by the same instructional video. Following the viewing of the video, the participants were given 6 practice attempts before values were taken. There were 2 separate raters: an athletic trainer with 10 years of experience and a physical therapist with 7 years of experience. The raters were blinded to the other rater's score. After the first trial with both raters, the participant would perform a second trial 20 minutes later with only one rater to test for intrarater reliability.

The Intraclass Correlation Coefficients (ICC) ranged from 0.85 to 0.91 for intrarater reliability and from 0.99 to 1.00 for interrater reliability. This showed that the Y-balance test has good to excellent intrarater reliability and interrater reliability.

A separate study by Shaffer et al[39] also tested the interrater reliability of the Y-balance test, but with 7 different raters. The raters were physical therapy students that underwent 10 hours of hands on training regarding how

to administer the Y-balance test. There were a total of 64 participants undergoing the Y-balance test.

The participants were randomly assigned to one of three raters on day 1. On day 2, the participants were randomly assigned to one of four raters. The participants viewed an instructional video on how to perform the test, and were allotted six practice trials before results were recorded.

After all the trials and measurements were completed, the ICC for interrater reliability came out to range from 0.85 to 0.93. These results supported Plisky et al's conclusion that interrater reliability for the Y-balance test was high.

Star Excursion Balance Test

The Star Excursion Balance Test (SEBT) is a tool used to assess dynamic balance, similar to the Y-balance test.[39] While standing on one leg, the person being tested reaches their opposite leg out in eight different directions: anterior, anterolateral, lateral, posterolateral, posterior, posteromedial, medial, and anteromedial. The goal is to reach out as far as possible while still maintaining balance and full foot contact with the grounded leg.[39]

Endo et al[40] conducted a study to determine if there was a relationship between lower extremity tightness and balance by using the Star Excursion Balance Test. The study was examining lower extremity tightness in baseball players specifically. The subjects in the study were 33 male junior high school baseball players. Muscle tightness measurement was achieved by taking passive, bilateral joint angle measurements of the quadriceps, iliopsoas, hamstrings, and gastrocnemius. Hip internal and external rotation was also measured with the hip flexed to 90 degrees and in the supine position.

The directions tested in this study were anterior, posterior, medial, and lateral. Reach distances were measured and compared to muscle tightness measurements. The study found a significant correlation between reach distance in the SEBT and muscle tightness. Gastrocnemius tightness was negatively correlated with anterior reach distance. There was a positive correlation between hip internal rotator and hamstring tightness with medial reach distance, and a negative correlation with the gastrocnemius. Lateral reach distance had a negative correlation with gastrocnemius and iliopsoas tightness.

The study stressed that tightness in the lower kinetic chain can lead to upper extremity injury in throwing

athletes, particularly baseball players. The SEBT can be used as a tool in upper extremity injury evaluation to examine if lower extremity muscle tightness could be contributing to the injury.[40]

The SEBT has also been shown to be able to identify patients with chronic ankle instability.[41] Comparing 48 young adults with chronic ankle instability to a control group of 39, Hertel et al had all of the participants perform the SEBT to determine which directions were most predictive of patients with chronic ankle instability. Data analysis revealed that using all 8 directions to screen patients with chronic ankle instability was very redundant.[41] It was found that there was a significant correlation between posteromedial, anteromedial, and medial reach distances and chronic ankle instability. With this information, a clinician can have a patient perform these 3 directions of the SEBT, rather than all 8, and still effectively screen for chronic ankle instability[41].

Intra-rater and Inter-rater Reliability of the Star Excursion Balance Test

To test the intra-rater and inter-rater reliability of the SEBT, Hyong et al[42] had 67 healthy subjects undergo a full SEBT assessment. Three raters were used to test

reliability. The participants were given six practice trials before measurements were taken. After the six practice trials, the participants performed the SEBT and measurements were taken three times for each of the eight directions. Rater A took the measurements twice in order to test intra-rater reliability, while raters B and C only took measurements once to measure inter-rater reliability.

ICCs were used to measure both intra- and inter-rater reliability. For all 8 directions, intra-rater reliability had ICC values ranging from 0.88 to 0.96. Inter-rater reliability had ICC values ranging from 0.83 to 0.93. These excellent inter-rater reliability results are similar to the results of Gribble et al.[43]

Gribble et al's study had 29 healthy participants and five raters conducting the assessment at two different testing locations, 19 at one and 10 at the other. Participants were allowed 4 practice trials before the assessment began. This particular study only had the participants perform the SEBT in the anterior, posteromedial, and posterolateral directions.

Following measurements from all 29 participants, data analysis revealed the ICC for inter-rater reliability as excellent, ranging from 0.89 to 0.94. Therefore, along with being a useful assessment to test for muscle flexibility[40]

and chronic ankle instability[41], studies have shown that the SEBT is a tool with excellent reliability.[42,43]

Selective Functional Movement Assessment (SFMA)

Unlike the previously mentioned functional movement screening tools, the Selective Functional Movement Assessment (SFMA) is not used as a predictive tool. Instead, the SFMA is used to assess pain that is present, followed by determining what the source of pain is and how to correct it.[44] Rather than assuming pain is deriving from a muscle flexibility or strength issue, the SFMA has the patient undergo a flow chart, with the path of the chart dictated by whether certain motions and movements elicit pain or not. If a patient can perform a motion, but with pain, then he or she would continue with the functional painful (FP) route. Otherwise, they would go down the chart with functional non-painful (FN). There are also dysfunctional painful (DP) and dysfunctional non-painful (DN) if the patient cannot perform the motion of that particular step.

At the end of the assessment, the SFMA determines if the problem is a tissue extensibility dysfunction, joint mobility dysfunction, or stability motor control dysfunction, as well as ways to correct the issue.[44]

This tool assesses everything from the cervical spine, to bilateral mobility of the knees and ankles. Combining this tool with the FMS or another functional movement screening tool can enable an evaluator and patient to prevent injuries while providing corrective exercises for pain that already exists. This will lead to a more functionally efficient patient.

Intra- and Inter-rater Reliability of the SFMA

Glaws et al[45] conducted a study in which 35 physical therapy students, as well as the Ohio State University Club Rugby team, underwent a full SFMA assessment. These participants were filmed simultaneously from both the sagittal and frontal planes by two different video cameras. Three raters were then asked to view the videos and assess the participants. The raters all had varying experience with the SFMA. Rater A was certified in the SFMA, had over 100 hours of education regarding the tool, and had been using it clinically for 3 years. Rater B had 25 hours of education regarding the SFMA, as well as 6 months of using the tool clinically. Rater C had 8 hours of education regarding the SFMA and had never used the assessment tool before. The raters were not present when the participants were filmed conducting the SFMA.

The raters evaluated each video using checklists and scoring systems of both the researchers and the SFMA. These video evaluations were repeated by the same raters one week later.

The researchers found that intra-rater and inter-rater reliability was greater with the raters that had more experience with the SFMA. The kappa coefficient and % agreement for intra-rater reliability was .83 and 91% for rater A, .78 and 88% for rater B, and .72 and 85% for rater C. Inter-rater reliability between the two most experienced raters had a .76 kappa coefficient and 88% agreement, whereas inter-rater reliability between the two least experienced raters had a .20 kappa coefficient and 62% agreement rate.

Supporting the finding that intra-rater and inter-rater reliability is greater in raters with more experience, the intra-rater ICCs were found to be 0.86 for rater A, 0.71 for rater B, and 0.58 for rater C with a 95% confidence interval. Inter-rater reliability between the two most experienced raters was found to be moderate with an ICC of 0.68. Between the two least experienced raters, inter-rater reliability was found to be poor with an ICC of 0.31. This study by Glaws et al emphasized the fact that a

more experienced rater will administer a more reliable assessment.

Conclusion

In conclusion, it is imperative for athletes to return their muscular strength ratios to acceptable levels before return to participation; otherwise they will continue to be extremely susceptible to re-injury. The acceptable ratios are 15% within strength for bilateral hamstring comparison and 60% hamstring to quadriceps strength. Adductor strength should be within 80% of abductor strength to avoid being more susceptible to adductor strains than a muscularly balanced athlete. Muscle imbalances can also lead to chronic injuries, such as patellafemoral pain syndrome and I.T band friction syndrome, not only acute muscle strains.

Pre-participation functional movement screenings can identify individuals at risk for injury. The literature states that if the individual scores less than a 14 on the FMS, they are more likely to sustain injury than those above the cut-off. If an individual does score less than a 14, it is entirely possible to raise the score through strengthening and stretching programs to get the score to an acceptable level.[30] Muscular imbalances are a major

intrinsic factor for injuries, and are completely preventable if the right measures are taken.

APPENDIX B

The Problem

STATEMENT OF THE PROBLEM

Functional movement screening tools have been shown to identify individuals that are more predisposed to injury than others due to muscular imbalances, and can dictate what sort of rehabilitation and corrections must be carried out. To date, there has been no published research regarding the usage of movement screenings in clinical practice by certified athletic trainers. Such useful tools should have high usage rates among athletic trainers. This study aims to examine those rates of usage, as well as athletic trainers' knowledge and perceptions of the screening tools.

Basic Assumptions

The following are basic assumptions of this study:

1) The participants will be honest when they complete their surveys.
2) The participants will all be certified athletic trainers who are members of the National Athletic Trainers' Association (NATA).

Limitations of the Study

The following are possible limitations of the study:

1) Not everyone who received the link to the survey participated.
2) No certified athletic trainers were be surveyed that were not NATA members.

Significance of the Study

The results of the survey show that there are almost as many athletic trainers that do use functional movement screenings compared to athletic trainers that do not. A vast majority of athletic trainers surveyed had a positive perception of functional movement screening tools, despite only 50% actually using the tools. Also, almost 90% of athletic trainers believe that functional movement screening tool information is not covered enough at athletic training conferences, whether it be national, regional, or a state conference.

Knowledge levels regarding recent research on functional movement screening tools was relatively low among the surveyed athletic trainers. More functional movement screening exposure at conferences may result in both higher usage rates and higher knowledge of functional movement screening tools. With research showing how useful these tools are in identifying at risk patients, it is

important for athletic trainers to become aware of exactly how beneficial these tools can be clinically.

APPENDIX C

Additional Methods

APPENDIX C1

Email Cover Letter/

Consent Form

Dear Athletic Trainer,

You have been selected to participate in a research study on the knowledge, use, and perceptions of functional movement screening tools among athletic trainers. This research study is being conducted as part of a Master's Research Thesis.

You have been selected to participate because you are a certified athletic trainer as well as a National Athletic Trainers' Association member. All survey responses are anonymous and will be kept confidential.

Participation in this study will take approximately 10 minutes. If you have any questions regarding this project, please feel free to contact the primary researcher, Dan Trinh, or the primary research advisor Dr. Lindsey McGuire (see contact information below).

If you are willing to participate in the study, please click the link below:

Thank you for your participation!

Sincerely,

Dan Trinh

Dan Trinh, LAT, ATC at tri7214@calu.edu or (201)450-7363

Lindsey McGuire, PhD, LAT, ATC at mcguire@calu.edu or (724)938-4823

APPENDIX C2

Institutional Review Board –

California University of Pennsylvania

California University of Pennsylvania
Morgan Hall, Room 310
250 University Avenue
California, PA 15419
instreviewboard@calu.edu
Robert Skwarecki, Ph.D., CCC-SLP,Chair

Dear Mr. Trinh,

Please consider this email as official notification that your proposal titled "Knowledge, use, and perceptions of functional movement screening tools by athletic trainers" (Proposal #14-030) has been approved by the California University of Pennsylvania Institutional Review Board as submitted.

The effective date of the approval is 2/2/2015 and the expiration date is 2/1/2016. These dates must appear on the consent form.
Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)
(2) Any events that affect the safety or well-being of subjects
(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).
(4) To continue your research beyond the approval expiration date of 2/1/2016 you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.
Regards,
Robert Skwarecki, Ph.D., CCC-SLP
Chair, Institutional Review Board

APPENDIX C3

Thesis Survey

***1. You have been selected to participate in a survey focused on the knowledge, use, and perceptions of functional movement screening tools among athletic trainers.**

You have been selected to participate due to being a certified athletic trainer as well as a National Athletic Trainers' Association member; however, participation completely voluntary and you have the right to choose not to complete this survey. You also have the right to discontinue participation at any time during the survey, at which time your data will be discarded. The California University of Pennsylvania Institutional Review Board has reviewed and approved this project. The approval is effective 02/02/15 and expires 02/01/16.

All survey responses are anonymous and will be kept confidential. Informed consent to use the data collected will be assumed upon return of the survey. Completed surveys will not have any information that will allow you to be identified or allow for your data to be associated with you. Electronic data will be stored in password-protected files. Minimal risk is posed by participating as a subject in this study. I ask that you please take this survey at your earliest convenience as it will take approximately 10 minutes to complete. If you have any questions regarding this project, please feel free to contact the primary researcher, Dan Trinh, LAT, ATC at tri7214@calu.edu or (201)450-7363, or the primary adviser Dr. Lindsey McGuire PhD, LAT, ATC at mcguire@calu.edu.

By clicking yes, you are indicating that you are 18 years of age or older, agreeing that you have read the above text in its entirety, and would like to voluntarily participate in the survey research. Would you like to continue?

◯ Yes

◯ No

***2. Which age range would you currently fall into?**

- ◯ 20-30
- ◯ 31-40
- ◯ 41-50
- ◯ 51-60
- ◯ 61+

***3. What is your sex?**

- ◯ Male
- ◯ Female

***4. How many years of experience do you have as an ATC?**

- ◯ 0-2
- ◯ 3-10
- ◯ 11-15
- ◯ 16-20
- ◯ 21+

***5. Which of the following settings do you work in?**

- ◯ High School
- ◯ College
- ◯ Professional
- ◯ Other (please specify)

***6. Which NATA district do you currently work in?**

- ◯ District 1 - CT, ME, MA, NH, RI, VT
- ◯ District 2 - DE, NJ, NY, PA
- ◯ District 3 - MD, NC, SC, WV, VA, DC
- ◯ District 4 - IL, IN, MI, MN, OH, WI
- ◯ District 5 - IA, KS, MO, OK, ND, SD, NE
- ◯ District 6 - AR, TX
- ◯ District 7 - AZ, CO, NM, UT, WY
- ◯ District 8 - CA, HI, NV
- ◯ District 9 - AL, FL, GA, KY, LA, MS, TN
- ◯ District 10 - AK, ID, MT, OR, WA

***7. Do you know any athletic trainers who use a functional movement screening tool in their practice?**

- ◯ Yes
- ◯ No

***8. Which of the following functional movement screening tools do you administer to your patients at least once a year? Check all that apply.**

- ☐ Functional Movement Screening
- ☐ Star Excursion Balance Test
- ☐ Y Balance Test
- ☐ Selective Functional Movement Assessment
- ☐ Generic screen of functional movements that the sports medicine staff created
- ☐ No functional movement screening tool
- ☐ Other (please specify)

***9. When do you use functional movement screening tools in your practice? Check all that apply.**

- [ ] Pre-season
- [ ] Before return to activity
- [ ] Following the conclusion of the season
- [ ] Other (please specify)

***10. Who administers the functional movement screening tool? Check all that apply.**

- [ ] Head athletic trainer
- [ ] Assistant athletic trainer/s
- [ ] Graduate assistant athletic trainers
- [ ] Student athletic trainers
- [ ] Team physician
- [ ] Coaches
- [ ] FMS Certified Assessor
- [ ] Other (please specify)

***11. On average, how many patients are you individually able to screen daily using a functional movement screening tool in preseason?**

- ◯ 0-50
- ◯ 51-100
- ◯ 101-150
- ◯ 151-200
- ◯ 201+
- ◯ I do not administer a functional movement screening tool in the pre-season

***12. If administered during preseason, how often is the functional movement screening tool used to screen patients? Check all that apply.**

- [ ] Yearly
- [ ] Every 2 years
- [ ] Freshman year
- [ ] Sophomore year
- [ ] Junior year
- [ ] Senior year
- [ ] I do not administer a functional movement screening tool during preseason

***13. Are you conducting any research using a functional movement screening tool?**

- ◯ Yes
- ◯ No

***14. How long have you been using a functional movement screening tool?**

- ◯ Less than a year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ 11+ years

***15. What functional movements are you using when administering a functional movement screening tool with your patients? Check all that apply.**

- [ ] Overhead deep squat
- [ ] Hurdle step
- [ ] Inline lunge
- [ ] Shoulder mobility
- [ ] Active straight leg raise
- [ ] Trunk stability push up
- [ ] Rotary stability
- [ ] Pistol squat
- [ ] Other (please specify)

***16. How are you utilizing the information received from the functional movement screening?**

- ◯ Individualized correction program
- ◯ Group correction program
- ◯ No intervention
- ◯ Other (please specify)

***17. Do you record and save data to later examine changes in injury rates in your patients?**

- ◯ Yes
- ◯ No

***18. Have you perceived a decline in injury rates in your patients from using functional movement screening tools?**

- ◯ Yes, I have perceived a significant decline in injury rates.
- ◯ Yes, I have perceived a small decline in injury rates.
- ◯ No, I have not perceived any change in injury rates.
- ◯ I am unaware of any changes in injury rates.

***19. Do you administer an extremity dependent assessment based on the demand of the athletes' sport (i.e. lower extremity screens for soccer)?**

- ◯ Yes, I only administer upper or lower extremity intensive screenings based on the specific activity/sport.
- ◯ No, I administer both upper and lower extremity intensive screenings no matter the activity/sport.

***20. How confident do you feel administering a functional movement screening tool?**

- ◯ Very confident
- ◯ Somewhat confident
- ◯ Neutral
- ◯ Somewhat unconfident
- ◯ Very unconfident

***21. Do you feel educational information of functional movement screening tools (research, utility, etc.) are covered sufficiently at national, regional, and state symposiums/meetings?**

- ◯ Yes
- ◯ No

***22. Would you attend a workshop on how to administer a functional movement screening tool at your national, regional, or state symposium/meeting?**

- ◯ Yes
- ◯ No

***23. What are some common problems, if any, that you have encountered from administering a functional movement screening tool?**

- ◯ None
- ◯ Other (please specify)

***24. How useful do you feel functional movement screening tools are in your clinical practice?**

- ◯ Very useful
- ◯ Somewhat useful
- ◯ Neutral
- ◯ Not very useful
- ◯ Not useful at all

***25. According to the research, does the Star Excursion Balance Test have good intra-rater and inter-rater reliability?**

- ◯ Yes
- ◯ No
- ◯ Unsure/unaware

***26. According to the research, does the Y-balance test have good intra-rater and inter-rater reliability?**

- ◯ Yes
- ◯ No
- ◯ Unsure/unaware

***27. According to the research, does the Functional Movement Screening have good inter-rater and intra-rater reliability?**

- ◯ Yes
- ◯ No
- ◯ Unsure/unaware

***28. Does your recorded data show a decline in injury rates?**

- ◯ Yes, the data has shown a significant decline in injury rates.
- ◯ Yes, the data has shown a slight decline in injury rates.
- ◯ No, the data has shown no decline in injury rates.
- ◯ I am unaware/have not analyzed my injury rate data.

***29. For what reason do you not administer a functional movement screening tool with your patients?**

- [ ] Costly tool
- [ ] Lack of time
- [ ] Lack of knowledge of functional movement screening tools
- [ ] Lack of comfort administering functional movement screening tools
- [ ] Perceived ineffectiveness
- [ ] Not in a position to decide/require implementation of functional movement screening tools
- [ ] Other (please specify)

***30. Would you attend a workshop on how to administer a functional movement screening tool at your national, region, or state symposium/meeting?**

- ◯ Yes
- ◯ No

***31. According to the recent research on the Functional Movement Screening, what is the current cut off score that determines when an athlete is more susceptible to injury?**

- ◯ 12
- ◯ 13
- ◯ 14
- ◯ 15
- ◯ 16
- ◯ Unsure/unaware

***32. According to the research on the Star Excursion Balance Test, asymmetrical reach differences of as little as how many centimeters predisposes an athlete to a greater risk of injury?**

- ◯ 2 centimeters
- ◯ 4 centimeters
- ◯ 6 centimeters
- ◯ 8 centimeters
- ◯ Unsure/unaware

***33. According to the research, which direction of the Star Excursion Balance test is most predictive of dynamic balance impairments in patients with chronic ankle instability?**

- ◯ Anterior
- ◯ Anteromedial
- ◯ Anterolateral
- ◯ Medial
- ◯ Lateral
- ◯ Posterior
- ◯ Posteromedial
- ◯ Posterolateral
- ◯ Unsure/unaware

***34. We would like to express our gratitude for your survey response and participation in this research study. It is very much appreciated and will help in progressing the athletic training profession. Please check the "Survey Completed" option below and submit your data. Thank you!**

◯ Survey Completed

References

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Knowledge, Use, and Perceptions of Functional Movement Screening Tools Among Certified Athletic Trainers

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Context: Every year, there are about 3.5 million injuries to high school athletes alone that cause some time loss from participation. Functional movement screening tools can identify muscular imbalances and suggest what type of strengthening or stretching an individual should perform to possibly prevent the occurrence of injury. To date, there has been no published research regarding the usage of functional movement screenings in clinical practice by athletic trainers. **Design:** The design of the research was a cross-sectional, online survey. **Participants:** Through the National Athletic Trainers' Association Research Survey Service, the research survey was distributed to 1,000 certified athletic trainers who were members of the NATA. A total of 152 participants completed the survey. **Results:** Of the 152 athletic trainers surveyed, 74 (48.7%) used at least one type of functional movement screening tool. The most commonly used functional movement screening tool used was the Functional Movement Screen, used by 64.9% of athletic trainers. The tools were rated as "very useful" by 78.3% of those athletic trainers. For athletic trainers who do not use the functional movement screening tools, only 4.1% perceived them as ineffective. The main reasons why these athletic trainers do not utilize functional movement screening tools are a lack of time (47%), lack of knowledge (41.9%), and/or they are not in a position to mandate the implementation of these tools to their athletes (36.5%). Knowledge levels were low, with only 23.3% of athletic trainers correctly answering the Functional Movement Screen knowledge question. Only 10.2% of athletic trainers surveyed correctly answered the first knowledge question regarding the Star Excursion Balance Test, and 3.9% correctly answered the second knowledge question regarding the Star Excursion Balance Test. **Conclusions:** The results of the survey revealed that athletic trainers generally view functional movement screening tools as useful and effective, despite only about half of athletic trainers utilizing these tools. Knowledge levels of the most recent research regarding functional movement screening tools were low, regardless of whether the athletic trainer used the tools themselves or not. **Word Count:** 438