CERTIFIED ATHLETIC TRAINERS PERCEPTIONS OF LOWER LIMB INJURIES THAT OCCUR ON ARTIFICIAL TURF VERSUS NATURAL GRASS

A THESIS

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by
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THESIS APPROVAL

Graduate Athletic Training Education

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INTRODUCTION

As each year passes, artificial turf is becoming the preferred field surface for outdoor athletics. Artificial turf can be seen at all levels of athletic competition. Many of us were taught early in our career that sport participation on artificial turf is more dangerous. As the artificial turf industry has advanced their products to become more like natural grass, the athletic shoe industry has modified their products as well to accommodate alternative field surfaces in order to help reduce the overall amount of injuries.

Artificial turf surfaces have been used for many years, dating back to the 1960's. Even though artificial turf has been around for many years; there is still speculation whether or not artificial turf increases the risk for injuries. Within the past decade many institutions have converted from natural grass to artificial turf to reduce maintenance costs, improve athletic performance, and appeal to recruits. As more institutions utilize artificial turf, we will begin to observe injury trends that may be

contributed to field surface or shoe selection, which will warrant further research.

The research that currently exists does not conclusively indicate if artificial outdoor athletic field surfaces are safer for athletic participation over the traditional natural grass fields. Many studies have examined the relationship between field surfaces and occurrence of injuries.[1-9] Meyers et al[1] compared the injury incidence rate of high school football games on FieldTurf, a new generation of artificial turf in filled with rubber particles compared to natural grass. The outcome of the research showed an injury incidence rate of 15.2 per ten games on FieldTurf versus 13.9 per ten games on natural grass. FieldTurf may have exhibited a higher incidence of injuries, but not high enough to say that it poses a statistically significant increase in risk. In addition, each field surface displayed distinctive injury patterns that merited further research. When Meyers[2] conducted further research, he used 24 Division I collegiate football teams to compare the incidence of injury on FieldTurf versus natural grass during games. From the 2253 total injuries documented, 1050 (46.6%) occurred on FieldTurf, and 1203 (53.4%) on natural grass. The research was funded by FieldTurf and a multivariate analysis per 10 team games

displayed significantly lower injury incidence rates on FieldTurf compared to artificial turf.

Football is not the only sport that is utilizing artificial turf. Many other sports such as soccer, field hockey, lacrosse, rugby, and even some baseball and softball fields now make use of artificial turf. To better understand how artificial turf affects soccer, Steffen et al[3] conducted a study that utilized 2,020 young female soccer athletes. The results of the study showed a higher incidence of ankle sprains on artificial turf compared to natural grass even though more games and overall injuries were documented on natural grass. Ekstran et al[4] found similar results while examining European club soccer players that competed and trained on artificial turf versus a control group of Swedish Premier League players. The higher rate of ankle sprains could be contributed to the sports increased demand for rapidly changing direction and a high rotational torque. More research is necessary to determine what type of affect artificial turf has on lower limb injuries for outdoor sports other than soccer and football.

In an effort to reduce injuries that do occur on artificial turf, several studies have been completed to highlight potential risk factors to include improper

footwear that leads to too little or too much shoe-traction.[5, 10-12] When Villiwock et al[5] performed a study that examined several different types of cleated shoes on four different field surfaces; the turf style cleat exhibited the least amount of rotational torque. High rotational torque values can contribute to lower limb injuries, whereas low rotational torque values may negatively affect athletic performance and contribute to injuries as well. Higher torque values will occur when an athlete wears improper footwear for a specific surface or cleats that are too long. Lower rotational torque values will take place when there is improper footwear selection and during inclement weather. Not only can the selection of proper footwear improve an athlete's performance, but it can reduce the incidence of a potential lower limb injury.

Other predisposing factors that contribute to the incidence of lower limb injuries that have been highlighted include an athlete's amount of playing experience, lack of ankle dorsiflexion, and/or injury history to name a few. Playing experience plays a role in the incidence of injury because an individual may not obtain the conditioning and proprioception necessary for their specific sport. In addition, some teams may practice on natural grass, but compete on artificial turf.

A lack of participation on artificial turf could alter the way an athlete competes, which will make them susceptible to potential injuries. A lack of ankle dorsiflexion was highlighted by Noronha et al[13] as being one of the biggest risk factors in predicting ankle sprains. A lack of dorsiflexion can potentially place an athlete's ankle in an open position, leaving it more unstable and vulnerable to ankle injuries such as sprains. As with most previous injuries, an athlete is more susceptible to reinjury. Knowledge of previous injuries affords a Certified Athletic Trainer the opportunity to take preventive measures such as muscle strengthening and joint bracing.

The primary purpose of this study is to examine Certified Athletic Trainers perceptions of lower limb injuries that occur on natural grass versus artificial turf. This study will attempt to answer the following questions: 1) Do Certified Athletic Trainers' perceive artificial turf to play a significant role in contributing to lower limb injuries when compared to natural grass? 2) Do Certified Athletic Trainers' of different collegiate governing bodies perceive artificial turf differently? 3) Do Certified Athletic Trainers' of different genders perceive the risks of artificial turf differently? 4) Do

the number of years an Athletic Trainer has been certified alter their perception about artificial turf?

METHODS

The purpose of this study was to examine the perceptions athletic trainers have about lower limb injuries that occur on natural grass versus artificial turf. This section will include the following subsections: Research Design, Subjects, Preliminary Research, Instruments, Procedures, Hypotheses, and Data Analysis.

Research Design

The research design for this study was descriptive as it provides a summary of Certified Athletic Trainers' opinions in regards to the relationship between field surfaces and injuries. The dependent variable was the perceived relationship of lower limb injuries that occur on natural grass versus artificial turf by Certified Athletic Trainers. The independent variables included an Athletic Trainers' gender, years certified, collegiate governing body affiliation, and playing surface. The strength of this study was that there have not been any previous studies examining the perception of athletic trainers about the role natural grass and artificial turf play in lower limb

injuries. Limitations for this study included the email addresses supplied by the National Athletic Trainers' Association (NATA) may not be valid, the participants may not work with an outdoor sport, and the participants may no longer work in a collegiate setting. Another limitation was the possibility that Certified Athletic Trainers may not know the exact type of playing surface they have at their institutions.

Participants

The participants for this study were 1000 randomly selected Certified Athletic Trainers' identified to be working in the collegiate setting by the National Athletic Trainers' Association (NATA). The random sample included Certified Athletic Trainers' from all 10 NATA Districts. All the participants in this study were currently employed as a Certified Athletic Trainer with at least one of the following outdoor sports; male or female soccer, male or female lacrosse, male or female field hockey, and/ or football.

Preliminary Research

The survey was created by the primary researcher in consultation with thesis committee members. After review by the committee, a panel of experts including 3 Certified Athletic Trainers' reviewed the survey and provided feedback in regards to grammar, clarity of the questions and validity.

Following Institutional Review Board (IRB) approval, a pilot study was conducted to confirm the reliability of the survey. The survey was administered to 20 Certified Athletic Trainers who are currently working with the fore mentioned collegiate sports. After one week these Certified Athletic Trainers' were surveyed a second time and reliability coefficients were calculated for each question. Of the 20 Certified Athletic Trainers selected, 11 completed the survey both times and their data was used in the reliability analysis. A Pearson Product Moment Correlation was used on all researcher created questions (Appendix C4). A majority of the questions displayed relativity scores of .30 or greater, indicating a moderate to strong correlation. Questions that did not display a strong reliability scores were retained because it was

determined that they would not affect the outcome of the hypotheses testing.

Instruments

A survey titled Artificial Turf Versus Natural Grass Perceptions (Appendix C2) was constructed by the researcher and distributed using Survey Monkey. The survey consisted of three primary sections. The first section contained two elimination questions to determine if the participant was qualified to complete the survey. The second section was comprised of five demographics questions which included: gender, collegiate governing body association, NATA District affiliation, primary sport affiliation, and years certified. The third and final section included thirteen perception questions that dealt with lower limb injuries, field surface utilization, inclement weather, and field surface risk assessment.

Procedures

The researcher applied and obtained approval from the IRB at California University of Pennsylvania (Appendix C1) before any research was conducted. The study was

distributed through an email to 1000 randomly selected Certified Athletic Trainers' chosen by the National Athletic Trainers' Association (NATA). To obtain email addresses the researcher contacted the NATA and requested the maximum amount of random email addresses for individuals currently working as a collegiate athletic trainer from all NATA Districts. Informed consent was not required for this survey because completion of the survey implied consent. In addition, accompanying the survey was a cover letter (Appendix C3) that explained the purpose of the study. A follow-up email was sent after the first week encouraging participants to complete the survey. At the end of the second week statistical data analysis began.

Hypotheses

The following hypotheses were based on previous research and the researcher's intuition based on a review of the literature:

1. Certified Athletic Trainers' will identify artificial turf to play a significant role in causing lower limb injuries when compared to natural grass.
2. There will be no difference in Certified Athletic Trainers' perceived risk of lower limb injuries that

occur on artificial turf versus natural grass in different collegiate governing bodies.

3. There will be no difference in Certified Athletic Trainers' perceived risk of lower limb injuries that occur on artificial turf versus natural grass by different genders.
4. There will be no difference in Certified Athletic Trainers' perceived risk of lower limb injuries that occur on artificial turf versus natural grass based on years certified.

Data Analysis

All data was analyzed by PASW version 18.0 for windows at an alpha level of 0.05.

1) To test the first hypothesis, an overall perceived mean risk score for lower limb injuries that occur on artificial turf when compared to natural grass will be calculated. Next, the researcher compared the perceived mean risk score to the following risk scale to determine the significance for the first hypothesis: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk,

1=Moderately Higher Risk, 2=Significantly Higher Risk.

2) A one-way ANOVA was used to determine if differences existed between Certified Athletic Trainers' from different collegiate governing bodies when perceiving lower limb injuries that occur on natural grass versus artificial turf differently.
3) A t-test was used to discover if difference exist between genders of Certified Athletic Trainers' and their perceptions of lower limb injuries that occur on natural grass versus artificial turf differently.
4) A one-way ANOVA was used to determine if differences exist between the number of years an Athletic Trainer has been certified and their perceptions regarding lower limb injuries that occur on natural grass versus artificial turf differently.

RESULTS

The purpose of this study was to examine Certified Athletic Trainers' perceptions about lower limb injuries that occur on natural grass versus artificial turf. The perceptions of Certified Athletic Trainers' were obtained using a survey created by the researcher. The following section contains the following subsections: demographic information, hypothesis testing, and additional findings.

Demographic Information

A sample of 1000 Certified Athletic Trainers' were randomly selected by the NATA and asked to participate in the survey. Of the 1000 asked to participate in the survey 237 responded and 163 fully completed the survey and were used for data analysis. The participants that fully completed the survey included 100 males and 63 females (Table 1). The survey included participants from all three NCAA Divisions and both NAIA Divisions (Table 3). In addition, individuals that answered "Other" in regards to their collegiate division association acknowledged being

from a National Junior College Athletic Association (NJCAA) affiliated institution or a community college.

Participants were given the option to answer "Other" in regard to their primary sport affiliation as well. From these responses, baseball and softball were retained, while those who answered tennis, track and field, and cross country were eliminated. Participants that stated they work with baseball and softball, were retained because there is a greater chance their sport uses natural grass and artificial turf field surfaces. Participants that stated they work tennis, track and field, and cross country were eliminated because their primary sport does not utilize natural grass or artificial turf. Gender, years certified, collegiate governing body affiliation, primary sport association, and NATA District association were all examined. The frequencies are reported in the following tables.

Table 1: Frequency Table for Gender

Gender	**Frequency**	**Percent**
Male	100	61.3
Female	63	38.7

Table 2: Frequency Table for Years Certified

Years Certified	Frequency	Percent
1-5	40	24.5
2-10	44	27.0
11-15	21	12.9
16-20	22	13.5
21-25	16	9.8
25-30	14	8.6
31+	6	3.7

Table 3: Frequency Table for Collegiate Governing Body Affiliation

Location	Frequency	Percent
NCAA Division I	46	28.2
NCAA Division II	30	18.4
NCAA Division III	45	27.6
NAIA I	10	6.1
NAIA II	9	5.5
Other	23	14.1

Table 4: Frequency Table for Primary Sport Affiliation

Sport	Frequency	Percent
Football	64	39.3
Men’s Soccer	33	20.2
Men’s Lacrosse	7	4.3
Men’s Field Hockey	0	0.0
Women’s Soccer	27	16.6
Women’s Lacrosse	8	4.9
Women’s Field Hockey	5	3.1
Other	19	11.7

Table 5: Frequency Table for NATA District Affiliation

NATA District	Frequency	Percent
District 1	22	13.5
District 2	21	12.9
District 3	21	12.9
District 4	29	17.8
District 5	16	9.8
District 6	9	5.5
District 7	7	4.3
District 8	13	8.0
District 9	19	11.7
District 10	6	3.7

Hypothesis Testing

The following hypotheses were tested in this study. The level of significance for each hypothesis was tested using a ≤ .05 significance level.

Hypothesis 1: Athletic Trainers' will identify artificial turf to play a significant role in causing lower limb injuries when compared to natural grass. Risk was rated utilizing the following scale: -2=Significantly Lower Risk, -1=Moderately Lower Risk, 0=Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk.

To determine if Athletic Trainers' identify artificial turf to play a significant role in causing lower limb injuries compared to natural grass, an overall perceived risk score was calculated. Table 6 below illustrates the perceived risk mean scores by lower limb injury location and overall risk.

Table 6: Perceived Risk Scores by Injury Location

Lower Limb Injuries	**Mean (SD)**
Foot Injuries	.28 (.714)
Ankle Injuries	.07 (.813)
Knee Injuries	.44 (.721)
Hip Injuries	.06 (.512)
Back Injuries	.15 (.524)
Overall Risk	.199 (.4648)

Risk was rated utilizing the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk

Conclusion: Based on the overall risk (.199) score, Athletic Trainers' do not significantly perceive artificial turf to play a significant role in lower limb injuries. Even though there is no significance, it should be noted that the perceived risk means in Table 6 all lean towards the higher risk than the lower risk.

Hypothesis 2: There will be no difference in Certified Athletic Trainers' perceived risk of lower limb injuries that occur on artificial turf versus natural grass in different collegiate governing bodies.

A one-way ANOVA was used to determine whether differences existed between Certified Athletic Trainers' and their perceptions of lower limb injuries that occur on artificial turf versus natural grass based on their

collegiate governing body affiliation. The mean scores for each division are found in Table 7.

Table 7: Mean Injury Risk by Collegiate Governing Body

Collegiate Governing Body	**N**	**Mean (SD)**
NCAA Division I	46	.278 (.4452)
NCAA Division II	30	.120 (.3881)
NCAA Division III	45	.218 (.4509)
NAIA I	10	.100 (.3559)
NAIA II	9	.222 (.6741)
Other	23	.139 (.5766)

Risk was rated utilizing the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk

Conclusion: The means for the perceived risk of artificial turf from each collegiate division affiliation were compared using a one-way ANOVA. No significant difference was found ($F(5,157)=.620, p>.05$).

Hypothesis 3: There will be no difference in Certified Athletic Trainers' perceived risk of lower limb injuries that occur on artificial turf versus natural grass by gender.

The mean scores for each gender were calculated and can be found in Table 8. An independent sample t-test was

used to determine if the perceptions of lower limb injuries on artificial turf versus natural grass varied by gender.

Table 8: Independent Sample T-Test Comparing the Mean Risk Scores Between Male and Female Certified Athletic Trainers'

Gender	n	Mean (SD)	t	P
Male	100	.246 (.3917)	1.643	.102
Female	63	.124 (.5570)		

Risk was rated utilizing the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk

Conclusion: An independent-samples t-test was calculated comparing the mean risk scores between male Certified Athletic Trainers' and female Certified Athletic Trainers'. No significant difference was found ($t(161)=1.643, p>.05$). The mean risk score for males was not significantly different from the mean risk score for females.

Hypothesis 4: There will be no difference in Certified Athletic Trainers' perceived risk of lower limb injuries that occur on artificial turf versus natural grass based on years certified.

Mean scores for the different age ranges can be found in Table 9. A one-way ANOVA was used to determine the perceptions of Certified Athletic Trainers' in regard to

lower limb injuries that occur on artificial turf versus natural grass based on years certified. The results from the one-way ANOVA are displayed below on Table 9.

Table 9: Mean Risk Scores by Years Certified

Years Certified	N	Mean (SD)
1-5	40	.180 (.3674)
2-10	44	.195 (.5274)
11-15	21	.171 (.4303)
16-20	22	.100 (.6377)
21-25	16	.475 (.4123)
25-30	14	.114 (.2905)
31+	6	.267 (.2422)

Risk was rated utilizing the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk

Conclusion: The means for the perceived risk of artificial turf based on years certified was compared using a one-way ANOVA. No significant difference was found ($F(6,156)=.289, p>.05$).

Additional Findings

Several other tests were conducted using the demographic section of the questionnaire in conjunction with the opinion questions.

A one-way ANOVA was used to determine the perceptions a Certified Athletic Trainer has in regards to lower limb

injuries that occur on artificial turf versus natural grass based on their primary sport. This was examined to determine if different sports have an increased or decreased perceived risk in regards to lower limb injuries on artificial turf.

Conclusion: The means for the perceived risk of artificial turf based on years certified was compared using a one-way ANOVA. No significant difference was found ($F(6,156)=.062, p>.05$). The results from the one-way ANOVA are displayed below on Table 9.

Table 10: Mean Risk Scores by Primary Sport

Sport	**N**	**Mean (SD)**
Football	64	.181 (.4272)
Men's Soccer	33	.261 (.4911)
Men's Lacrosse	7	.086 (.5757)
Men's Field Hockey	0	.000 (.0000)
Women's Soccer	27	.319 (.4161)
Women's Lacrosse	8	.075 (.3991)
Women's Field Hockey	5	-.400 (.9695)
Other	19	.232 (.3215)

Risk was rated utilizing the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk

To determine the perception a Certified Athletic Trainer has in regards to lower limb injuries that occur on

artificial turf versus natural grass based on their NATA District affiliation, a one-way ANOVA test was conducted.

Conclusion: The means for the perceived risk of artificial turf based on NATA District affiliation was compared using a one-way ANOVA. No significant difference was found ($F(9,153)=.296, p>.05$). Table 10 provides the mean scores for each District.

Table 11: Mean Risk Scores by NATA Districts

NATA District	N	Mean (SD)
District 1	22	.209 (.3115)
District 2	21	.305 (.4588)
District 3	21	.333 (.5598)
District 4	29	.117 (.5113)
District 5	16	.062 (.4717)
District 6	9	.067 (.1732)
District 7	7	.486 (.4140)
District 8	13	.015 (.4356)
District 9	19	.221 (.4158)
District 10	6	.267 (.7554)

Risk was rated utilizing the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1= Moderately Higher Risk, 2= Significantly Higher Risk

Further, the researcher asked the participants a variety of perception questions. The tables below display the frequencies of these questions. Table 12 shows that natural grass was perceived to be attributable to the least

amount of injuries. For acute contact injuries, a vast majority of the participants found there to be no difference in field surface in relationship to acute contact injuries.

To determine if Certified Athletic Trainers' perceive weather on different field surfaces to impact lower limb injuries, the participants were asked to choose which field surface was safer for participation during rainy, snowy, and cold weather. In general, artificial turf was perceived to be safer than natural grass during inclement weather (Table 13). Table 14 displays the frequency for which surface Certified Athletic Trainers' perceived to be safer. With 43.6% of the participants choosing natural grass to be safer, 24.5% choosing artificial turf, and 31.9% claiming there is no difference between field surfaces, the data from Table 14 compared to Table 6 show that participants were consistent in perceiving artificial turf to have slightly more risk for athletic participation.

Additionally, the participants were asked to identify which type of field surface their primary sport utilized during practice and games, the condition of their field, the measures taken to prevent injuries, and what field surface they perceived specific injuries to occur more often. Table 15 shows which type of field surface the

participant's primary sport utilizes during practice and games and Table 16 displays the perceived condition of the participant's field surface. The participants were asked to check all the measures they have taken to prevent injuries during supervision of their primary sport. The participants that answered "Other" stated that they implement prevention exercise programs, utilize orthopedic braces, employ proper stretching programs, and make use of warm-up protocols. These results can be found in Table 17.

In order to determine if any injury patterns existed on natural grass or artificial turf, the participants were asked to choose which field surface they perceived specific injuries to occur more often. Table 18 shows that turf toe (67.5%) and shin splints (58.9%) were the only injuries to be chosen to occur more often on artificial turf than natural grass or no difference. In general, the participants perceived artificial turf to be injury inducing overall except for lateral and medial ankle sprains.

Table 12: Frequency Table for Certified Athletic Trainers' Perception of Different Field Types and Their Role in Different Injury Categories

Field Surface	Acute Non-Contact N (Percent)	Acute Contact N (Percent)	Chronic N (Percent)
Natural Grass	32 (19.6)	21 (12.9)	23 (14.1)
Artificial Turf	65 (39.9)	29 (17.8)	80 (49.1)
No Difference	66 (40.5)	113 (69.3)	60 (69.3)

Table 13: Frequency Table of Certified Athletic Trainers' Perceptions of Which Field Surface is Safer for Athletes to Practice and Compete on During Inclement Weather

Field Surface	Rainy Weather N (Percent)	Snowy Weather N (Percent)	Cold Weather N (Percent)
Natural Grass	34 (20.9)	44 (27.0)	43 (26.4)
Artificial Turf	88 (54.0)	62 (38.0)	52 (32.5)
No Difference	41 (25.2)	56 (34.4)	65 (39.9)

Table 14: Frequency Table for Certified Athletic Trainers' Overall Perception of Which Field Surface is Safer

Field Surface	N (Percent)
Natural Grass	71 (43.6)
Artificial Turf	40 (24.5)
No Difference	52 (31.9)

Table 15: Frequency Table for Certified Athletic Trainers' Field Surface Utilization During Practice and Games

Field Surface	Practice N (Percent)	Games N (Percent)
AstroTurf	11 (6.7)	11 (6.7)
FieldTurf	62 (38.0)	61 (37.4)
Natural Grass	85 (52.1)	86 (52.8)
I do not know	0 (0.0)	1 (.6)
Other	5 (3.1)	4 (2.5)

Table 16: Frequency Table for Certified Athletic Trainers' Perceived Condition of Their Field Surface

Field Condition	N (Percent)
Excellent	63 (38.7)
Good	78 (47.9)
Poor	22 (13.5)

Table 17: Frequency Table for Preventive Measures Taken by Certified Athletic Trainers' While Supervising Their Primary Sport

Field Surface	N (Percent)
Recommended proper footwear based on field surface	136 (83.4)
Inspected field for irregularities	116 (71.2)
Acclimated athlete(s) to new field surface	45 (27.6)
Other	11 (6.7)

Table 18: Frequency Table for Certified Athletic Trainers' Perceptions on the Field Surface Associated with Specific Lower Limb Injuries

Injury	Natural Grass N (Percent)	Artificial Turf N (Percent)	No Difference N (Percent)
Turf Toe	7 (4.3)	110 (67.5)	46 (28.2)
Jones Fracture	10 (6.1)	31 (19.0)	121 (74.2)
Lateral Ankle Sprain	52 (31.9)	13 (8.0)	98 (60.1)
Medial Ankle Sprain	31 (19.0)	17 (10.4)	115 (70.6)
High Ankle Sprain	25 (15.3)	44 (27.0)	94 (57.7)
Shin Splints	23 (14.1)	96 (58.9)	44 (27.0)
ACL N-C Injuries	15 (9.2)	69 (42.3)	78 (47.9)
ACL Contact Injuries	15 (9.2)	24 (14.7)	124 (76.1)
MCL N-C Injuries	14 (8.6)	41 (25.2)	108 (66.3)
MCL Contact Injuries	14 (8.6)	18 (11.0)	130 (79.8)
LCL N-C Injuries	11 (6.7)	25 (15.3)	126 (77.3)
LCL N-C Injuries	14 (8.6)	13 (8.0)	136 (83.4)
Meniscal Injuries	20 (12.3)	49 (30.1)	94 (57.7)
Hip Injuries	14 (8.6)	23 (14.1)	125 (76.7)
Lower Back Injuries	15 (9.2)	44 (27.0)	103 (63.2)
Tibia-Fibula Stress Fx	15 (9.2)	59 (36.2)	86 (52.8)

N-C= Non-Contact

DISCUSSION

This study has produced a number of findings related to the perceived risk that playing surface may have on athletic injury. The following section will discuss these findings and is divided into the following subsections: Discussion of Results, Conclusions, and Recommendations.

Discussion of Results

This study focused on Certified Athletic Trainers' perceptions in regards to lower limb injuries that occur on artificial turf versus natural grass. The researcher examined different demographic information such as gender, collegiate division affiliation, and years certified to see if it affected their perceptions of lower limb injuries that occur on natural grass versus artificial turf.

The researcher's first hypothesis was that Athletic Trainers' would identify artificial turf to play a significant role in causing lower limb injuries when compared to natural grass. There was no previous research performed that examined the perceptions Certified Athletic Trainers' have about lower limb injuries on natural grass

and artificial turf. Based on the researchers own experiences and intuition, it was thought that artificial turf would play a significant role in causing lower limb injuries. However, no significant results were shown to support this hypothesis. With a lack of significance to show that artificial turf is more dangerous than natural grass, the results from this study supports the research conducted by Meyers et al[2].

The second hypothesis examined in this study stated that there will be no difference in the perceptions of lower limb injury risk that occur on artificial turf versus natural grass by Certified Athletic Trainers' in different collegiate governing bodies. The researcher hypothesized that an institution affiliated with a higher division such as NCAA Division I may be able to afford a higher quality playing surface than an institution in a lower division. A high quality playing surface would provide a more consistent field surface, which could help eliminate lower limb injuries and alter Certified Athletic Trainers' perceptions. Although the results did show a perception that artificial turf is slightly not as safe natural grass, Certified Athletic Trainers' from different collegiate governing bodies did perceive lower limb injury risk that occurs on artificial turf versus natural grass similar

manner. The results support this hypothesis even though no significance was found in the first hypothesis.

The third hypothesis stated by the researcher was that Certified Athletic Trainers' of different genders will perceive lower limb injury risk that occurs on natural grass versus artificial turf the same. With current research involving gender difference in regards to lower limb injuries, it was thought that Certified Athletic Trainers of different gender could potentially have different perceptions of lower limb injuries that occur on natural grass versus artificial turf. Results showed that the perceived mean risk score for the males was .246 and .124 for females. The significance level for the t-test was .056. The hypothesis of no difference in perceived risk is supported by these results.

The researcher's final hypothesis stated that there will be no difference in perceptions of lower limb injuries that occur on natural grass versus artificial turf regardless of how many a Certified Athletic Trainer has been certified. With artificial turf evolving from a carpet like AstroTurf to grass like FieldTurf, it was thought that individuals that have been certified longer may have a different perception of lower limb injuries that occur on natural grass versus artificial turf. Nonetheless, the

results did not show any significant difference between perceptions based on the number of years an individual has been a Certified Athletic Trainer. It is interesting to note that the 16 Athletic Trainers' that have been certified for 21-25 years had a perceived mean risk score of .475. This is more than double the overall perceived risk score for all the participants. However, the results from the one-way ANOVA still support the hypothesis of no difference in perception of risk due to the number of years certified.

In addition to examining the hypotheses, the researcher discovered additional findings by using supplementary demographic and perception questions. These additional findings were made using perceived mean risk scores and frequencies.

The first additional finding used Certified Athletic Trainers' from different sports to determine if perception on lower limb injuries that occur on natural grass versus artificial turf altered. The significance level for the one-way ANOVA used to measure the relationship for this additional finding was .062, deeming it insignificant. However, the highest perceived mean risk score of .319 was recorded by 27 Certified Athletic Trainers' who work with women's soccer and the lowest of -.400 came from the 5

Certified Athletic Trainers' who stated they work with women's field hockey.

Beyond examining the different primary outdoor sport a Certified Athletic Trainer works with, NATA District was examined to determine if Certified Athletic Trainers' perceptions change based on their location. Once again, no significance was discovered from the one-way ANOVA. NATA District 7(Arizona, Colorado, New Mexico, Utah, and Wyoming) displayed the highest perceived mean risk of .486. Whereas, NATA District 8(California, Hawaii, and Nevada) displayed the lowest perceived risk of .015. These comparisons of perceived mean risks are interesting because the two districts are relatively close to each other.

The results of this study both support and oppose the results of previous studies. Although the overall results did not demonstrate that athletic trainers perceive artificial turf to be less safe than natural grass, it did not show artificial turf to be perceived more dangerous either. Certified Athletic Trainers did not perceive ankle injuries to have a significant perceived mean risk score, which did not defend the findings that ankle injuries occur more often on artificial turf than natural grass as found by Steffen et al and Ekstrand et al.[3, 4] Additionally, the findings in Table 18 show medial and lateral ankle sprains

were perceived to occur more often on natural grass compared to artificial turf. These perceptions are contrary to the findings by Steffen et al and Ekstrand et al.[3, 4] In addition, Meyers found FieldTurf to safer than natural grass, which was not displayed by Certified Athletic Trainers' perceptions.[1]

Conclusions

There were no significant differences found between Certified Athletic Trainers from different collegiate governing bodies, gender, years certified, NATA Districts, and primary sports in the amount of injury risk they perceive due to athletic turf surface. Based on the results of this study, we can conclude that Certified Athletic Trainers' have similar perceptions of lower limb injuries that occur on natural grass versus artificial turf. Regardless of collegiate governing body, gender, years certified, sport, and NATA District, Certified Athletic Trainers' do not significantly perceive artificial turf to be more dangerous than natural grass in regards to lower limb injuries. This could be a credit to the evolution of artificial turf, development of proper footwear, and/or proper training for a specific sport.

Recommendations

The results of this study demonstrate that, in general, Certified Athletic Trainers' agree that there is no significant difference between the potential lower limb injury risks on natural grass versus artificial turf. In order to aid in determining if field surfaces play a role in lower limb injuries, future research could obtain the perceptions of athletes through a survey similar to the one used in this study.

In addition, further research should track lower limb injuries by field surface, sport, collegiate governing body, gender, shoe manufacturer, and weather conditions. This would give a better outlook as to whether or not field surface play a significant role in lower limb injuries and also determine if there is a difference between Certified Athletic Trainers' perceptions and actual injury prevalence. A large prospective study examining these factors would help guide Certified Athletic Trainers in preventing injuries that might be due to the shoe-surface interface.

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APPENDICES

APPENDIX A

Review of Literature

REVIEW OF LITERATURE

On a yearly basis, an increasing number of collegiate athletic teams are converting from natural grass to artificial turf surfaces. Although the initial costs are high, the reduced time and money spent in maintaining artificial turf is second to none. In order to understand the potential healthcare benefits and/or risks of artificial turf compared to natural grass it is important to examine the perceptions athletic trainers have about lower body injuries that occur on each type of surface.

The purpose of this Review of Literature is to analyze how athletic trainers perceive the prevalence of lower body injuries that occur on natural grass versus artificial turf. This will be accomplished in the following sections: Bony and Ligamentous Anatomy, Risk Factors, Artificial Versus Natural Grass, and Preventative Measures. The review of literature will end with a summary of the research performed to date.

Bony and Ligamentous Anatomy

Reviewing the literature as it pertains to anatomy is important to highlight the structures that are at risk with lower limb injuries. With the ankle and knee commonly injured during athletic participation, the following sections will describe some of the structures that an individual may injure.

Ankle

The distal end of the tibia and fibula, the talus, and the calcaneus are all bones that make up the ankle.[1] The superior and inferior tibiofibular joints, the talocrural joint, and the subtalar joint are all made up by the articulations between those bones. The distal end of the tibia and the lateral malleolus make up the inferior tibiofibular joint. The talocrural joint, which is a hinge joint, is formed by the distal tibia, the trochlea surface of the talus, and the medial malleolus. Dorsiflexion and plantar flexion occurs at this joint. The articulation between the calcaneus and talus forms the subtalar joining.[1] Movements that occur at the joint include inversion, eversion, pronation and supination.

There are many ligaments that provide static support at the ankle. The lateral ligaments include the anterior talofibular ligament (ATF), posterior talofibular ligament (PTF), and the calcaneofibular ligament (CF).[1] On the medial side there is one major ligament called the deltoid ligament.[1] This ligament resists eversion and although it has four parts to it, it is still considered to be one ligament.

Knee

The knee joint consists of the femur, tibia, fibula, and the patella. It is one of the most traumatized joints among the physically active population due to the extreme stresses exerted on it.[1] The articulations that exist at the knee include; the superior tibiofibular joint, the patella femoral joint, and the tibiofemoral joint.

Within the articulations of the knee lie many ligamentous and essential structures. On top of the articular facets of the tibia are menisci. The medial meniscus is "C" shaped, whereas the lateral meniscus is "O" shaped.[1] Both provide a larger articulation surface between the tibia and femur, absorb pressure, and stabilize the knee. Along with the meniscus, there are four major ligaments that assist in stabilizing the knee. The two

cruciate ligaments cross each other as they travel through the joint cavity of the knee.[1] The anterior cruciate ligament (ACL) aids in preventing the femur from translating posteriorly during weight bearing.[1] The ACL stabilizes the tibia against excessive internal rotation and serves as a secondary restraint for varus and valgus forces as well. The posterior cruciate ligament (PCL) resists hyperextension of the knee and femur. On the medial aspect of the knee lies the medial collateral ligament (MCL). The MCL is the primary restraint against valgus forces and excessive external rotation. The MCL crosses the medial joint line attaching on the medial epicondyle of the femur and below on the tibia. Additionally, a portion of the MCL attaches to the medial meniscus. The lateral collateral ligament (LCL) attaches from the lateral epicondyle of the femur to the head of the fibula. The LCL primary resists varus forces that act on the knee. The foot, ankle, knee, and hip all compose the lower limb kinetic chain and when forces act on the foot and ankle it can cause additional stress at the knee joint, which may lead to injury.

Risk Factors

Athletes from all sports are susceptible to injuries at any given time and many times it is too late for them to prevent the injury from occurring. The literature reviewed in the following sub-sections will look at shoe-surface traction and predisposing factors as being risk factors associated with lower body injuries. Being able to identify injury risks will justify further research and enable individuals to take the necessary actions to prevent injuries.

Shoe-Surface Traction

Not only does the type of surface affect injury risk, but the shoes utilized by athletes matter as well. In most cases, a positive correlation exists between shoe-surface traction and ground hardness.[2] There is a higher risk for the incidence of injury due to an increased surface hardness and shoe-surface traction. Orchard et al looked at numerous articles to discover that shoe-surface traction will be elevated on hard and dry natural grass when grass cover and root density are at their maximum.[2] Plus, cleat

length contributes to the amount of shoe-surface traction an individual exhibits.

In addition, cold weather is associated with an increased lower limb injury rate for knee and ankle sprains on both artificial turf and natural grass.[3] The higher rate of lower limb injuries is explained with a decrease in shoe-surface traction. In order to have the right amount of traction, a balance between shoe and surface types must be determined.

Furthermore, footwear should be selected on the amount of rotational traction and surface type to help decrease the probability of possible lower limb injury. Villwock et al examined ten different types of football shoes on four different types of field surfaces: artificial turf, FieldTurf, AstroPlay, and natural grass. With the use of a mobile testing apparatus that applied rotational force and measured torque at the shoe-surface interface the researchers were able to collect data on actual surface installations. Both artificial turf surfaces demonstrated a greater rotational torque when compared to the natural grass surfaces.[4] A greater rotational torque can augment the likelihood of lower limb injuries. Most importantly, the turf-style cleat significantly exhibited the lowest amount of torque compared to ten different shoe models.[4] With

artificial surfaces evolving, it is important to continue to conduct shoe and surface experiments to optimize an athlete's performance and reduce the risk of injury.

To reduce injuries on both natural grass and artificial surfaces it is important to select proper footwear. A cleat with more spikes may need to be selected in order to reach desired shoe to surface traction when cold weather creates a hard surface. A natural grass field with maximum grass cover and root density may require a cleat with longer spikes to reduce shoe to surface traction. Shoe selection for artificial turf is just as important as well, knowing that a rotational torque on FieldTurf and AstroPlay is greater than natural grass surfaces.[4] A balance between safety and performance must be determined when selecting shoes for a specific surface in order to achieve the lowest amount of injury risks and the highest amount of athlete success.

Predisposing Factors

Beyond worrying about shoe to surface traction, it is also important to look at risk factors that may predispose an athlete to a lower limb injury. de Noronha et al conducted a systematic review of twenty-one research studies, aimed to determine if voluntary strength,

proprioception, range of motion, or postural sway could predict the occurrence of lateral ankle sprains. From the initial results a lack of dorsiflexion was determined to be the biggest risk factor in predicting lateral ankle sprains.[5]

Moreover, Trojian and McKeag used a single leg balance test to predict ankle sprains in 230 male and female athletes from one high school and three colleges. Main results showed individuals were at risk for future ankle sprains when a positive single leg balance test was observed. The researchers also observed an even higher risk of ankle sprains when athletes did not tape their ankles.[6] Trojian and McKeag were able to claim the single leg balance test as a valid test for predicting ankle sprains.[6]

Additionally, foot characteristics can be a predictor for lateral ankle sprains as well. Morrison and Kaminski looked at high longitudinal arches, greater foot widths, cavovarus foot deformities, women with increased open chain calcaneal eversion range of motion, greater metatarsophalangeal joint extension, and a more laterally situated gait.[7] After Morrison and Kaminski reviewed the literature, they concluded that more reliable measurement techniques should be developed and utilized to better

understand the relationship between foot characteristics and lateral ankle sprains.[7]

Further, an athlete may be at risk for lower limb injuries based on factors other than their anatomical and mechanical structure of their bodies. Hagel et al looked at men's varsity football players in the Canada West Universities Athletic Association for five years to determine the injury risk factors. From the results Hagel et al collected, injury rates were high during competition compared to practice periods.[8] Lower extremity injury rates during games were greater on artificial turf than on natural grass during both wet and dry field conditions. From the research performed by Hagel et al, they were able to conclude that the risk factors for injuries included, but were not limited to participation during games, being a veteran player, playing on artificial turf, and having a previous history of injuries.[8]

Previous Artificial Turf Versus Natural Grass Studies

Due to the evolution of artificial turf, a vast amount of studies are being developed to determine if each new artificial turf is safer than natural grass. Many of these studies take into account, in-shoe to surface loading, the

frequency of injuries, the mechanisms of the injuries, and the severity of the injuries. The following sections will be broken into comparisons of artificial turf versus natural grass based on injuries, shoe to surface loading, and artificial turf comparisons.

Injuries

Long before artificial turf began to evolve into what it is today, AstroTurf existed and widely became the popular choice for many collegiate and professional teams. To determine if AstroTurf increased the incidence of lower limb injuries, Powell et al used a multivariate risk analysis to compare the risk factors associated with injury rates by position in the National Football League on different playing surfaces. The collected data showed a significant statistical difference between the higher injury rates for knee sprains on AstroTurf and natural grass.[9] When knee sprains are divided into MCL and ACL sprains, only the ACL injuries show a higher injury rate on AstroTurf compared to natural grass. The researchers were able to conclude that AstroTurf increased the risk of anterior cruciate ligaments for National Football League players from the years 1980-1989.[9]

As artificial turf became popular, Tartan turf was created. Tartan turf eventually became a competitor of AstroTurf. AstroTurf and Tartan turf were primarily the same type of artificial turf. A retrospective and prospective comparative study was performed to compare injuries that occurred on Tartan turf and natural grass at the University of Wisconsin.[10] Retrospective data was collected through 235 questionnaires that were returned by athletes who played from 1960 to 1973. Prospective data was collected through examination of injured athletes from 1975 to 1977. Results showed a significantly higher amount of serious injuries such as sprains and ligament tears that were sustained on natural grass compared to minor scrapes that occurred on the Tartan turf.[10] In conclusion, the researchers suggested that athletes may be returning to play on grass fields too quickly following the occurrence of an injury.

FieldTurf is now the dominant choice of artificial turf for all levels of competition in many different sports. To compare the incidence, causes, and severity of high school football injuries on FieldTurf versus natural grass, Meyers et al utilized a prospective cohort study during a five year period with eight high schools. Results showed an injury incidence rate of 15.2 per ten team games

on FieldTurf compared to 13.9 per ten team games on natural grass.[11] Meyers et al concluded that although the injury rates were similar between FieldTurf and natural grass, each surface displayed distinctive injury patterns that merit further research.[11]

When the prevalence of injuries during competition was examined, Meyers hypothesized that a difference did not exist between FieldTurf and natural grass.[12] The study Meyers conducted utilized twenty four Division I collegiate football teams to quantify the incidence, mechanisms, and severity of collegiate football game related injuries during a span of three years. To accomplish this, a prospective cohort study was used with a two-sided single page injury surveillance form.[12] When data analysis concluded, FieldTurf was determined to be safer than natural grass when comparing game related injuries.[12] It should also be noted that a bias of results is a limitation of this study because the research performed was funded by FieldTurf.

Many other sports utilize artificial turf as well, which is why Steffen et al conducted a prospective cohort study. Subjects for this study consisted of 2,020 young female football athletes from 109 different teams. The results showed a higher incidence of ankle sprains on

artificial turf even though more games and overall injuries were documented on natural grass.[13] Similar results were found in a two cohort study performed by Ekstrand et al. Ekstrand et al looked at 290 male European club football players who competed and trained on artificial turf, where the control group consisted of 202 male Swedish Premier League players.[14] Overall, results showed no difference between the incidences of injuries that occurred on artificial turf versus natural grass, but similar to the study conducted by Steffen et al; a higher rate of ankle sprains was reported on artificial turf.[13,14]

Shoe-Surface Loading

In addition to determining what type of field surface is safer from an injury standpoint, researchers have found importance in studying the differences between in-shoe loading patterns on both artificial turf and natural grass as well. Ford et al used seventeen male football players to test in-shoe foot loading patterns while performing cutting actions in a slalom course.[15] The results of the study showed that artificial turf had significantly higher peak pressures within the central forefoot and lesser in the toes when compared to the natural grass.[15] In contrast, the medial forefoot and lateral midfoot exhibited higher

relative loads. There was no difference in maximal effort sprint times. The authors of this study concluded that different playing surfaces alter the amount of plantar force and that further research should be conducted to determine sport specific injuries.[15]

A study completed by Queen et al aimed to examine the effect of different cleat plate configurations on plantar pressure during a cross cut and side cut. The subjects for this study consisted of thirty-six healthy athletes who participated in a cleated sport at least twice a week. All of the subjects were asked to run a course five times wearing four different styles of the Nike Vitoria cleats to that included: bladed, elliptical firm ground, hard ground and turf. Pressure was measured using Pedar-X insoles.[16] After data was examined, an observed significant variance in forefoot loading patterns existed among cleat types. The researchers suggest that it might be advantageous to increase the forefoot cushioning in cleats to help decrease forefoot loading.[16]

Along with testing loading patterns, a study conducted by Heidt et al examined the shoe-surface interaction of fifteen football shoes made by three different manufacturers in both anterior translation and rotation using a specially designed pneumatic testing system.[17] All

shoes were tested under a twenty-five pound axial load on synthetic turf both wet and dry and on natural stadium grass. The authors also noted that the spatting of a football shoe resulted in a reduction of forces generated for both translation and rotation. The authors of this study determined that improper footwear for specific field surfaces impose a higher level of injury risk.[17] Moreover, it was also recommended that shoe manufacturers display suggested indications and ideal surface use for which their shoes are intended.

Artificial Turf Comparisons

Additionally, due to the evolution of artificial turf surfaces, it is essential to compare the different types of artificial turf. To test five different types of professionally used football turf an instrumented computerized impact recording device was used to test for increased or decreased impact attenuation. The impact recording device was dropped twenty times from a height of four feet on each surface type. The results of the study showed no significant difference between older foam turf and new rubber shredded based turf.[18] However, there were locations within the shredded based turf that was compacted in which it became a harder surface when compared to the

older foam turf. This research concluded that impact attenuation has not been altered with the production of newer shredded rubber based turf.[18]

Preventive Measures

There are many different options an individual can take to decrease the probability of a lower limb injury. Utilizing ankle taping and bracing, proprioception training, and shoe selection are a few of several ways an individual can help prevent a lower limb injury.

Taping and bracing have long been used to help reduce the incidence of ankle sprains in athletes. When Kadakia and Haddad reviewed eight studies, they looked at the role of ankle bracing and taping in secondary prevention of ankle sprains in athletes. After reviewing the literature they determined that that there is enough biomechanical evidence that supports the mechanical advantage of semi-rigid orthoses for restriction of inversion and eversion at the ankle after prolonged and brief stages of exercise.[19] It was also noted that the current experimental data validates that any taping and bracing is effective in reducing the incidence of secondary ankle sprains.[19] Taping and bracing are both reasonable options when attempting to prevent

ankle sprains, but primary prevention of ankle sprains should be examined at as well.

Proprioception is often used when treating individuals for ankle sprains. A review article constructed by Eils aimed to discover the role of proprioception in the primary role of preventing ankle sprains in athletes. From eight studies, Eils was able to conclude that even though proprioception programs are favored in primary ankle sprain prevention for healthy subjects, there is no evidence that supports these proprioception prevention programs.[20] However, it was noted that a proprioception program can be promising for individuals with a history of ankle sprains.[20] Prevention of ankle sprain may not even involve bracing, taping, and/ or proprioception, but rather the biomechanical aspects of an artificial turf.

Moreover, a review article by Dixon et al, takes a multidisciplinary approach by looking at the artificial turf properties from a sports medicine, engineering and biomechanics point of view. To optimize the sports medicine field it is necessary for the engineering field to approach artificial turf on a sport specific basis to help reduce injuries.[21] In conclusion the author recommends shoe and surface companies to work together to develop an ideal shoe and surface for a specific group of athletes.[21]

Summary

The technology and advancement of artificial turf has created many different variables that one must account for when choosing to participate on a desired field surface. While many believe artificial turf improves athletic performance and is safer, others argue that traditional natural grass still prevails over man-made synthetic field surfaces. Every year there are new teams at each athletic level that convert to artificial turf for a variety of reasons. As more and more teams do begin to utilize artificial turf it is important that the athletic training society continues to remain aware of the possible health risks.

To ensure athletes can reach their fullest potential of athletic performance while remaining safe, it is imperative that research continues to better understand the potential risks involved with artificial turf participation. Everything from shoes to playing experience must be considered when determining the variables that contribute to lower limb injuries on different field surfaces. More research must be embarked upon to remain at

the same level of progression as the artificial turf market.

APPENDIX B

The Problem

THE PROBLEM

Statement of the Problem

The primary scope of this study is to determine if Certified Athletic Trainers in the collegiate setting perceive a difference in lower limb injuries that occur on artificial turf versus natural grass. There have been conflicting reports about whether artificial turf impacts lower limb injuries more compared to natural grass. Some research shows artificial turf to be safer while others have found it to be unsafe or have no difference compared to artificial turf. A study performed by Meyers et al showed that the injury rate between artificial turf and natural grass were similar, but each displayed distinctive injury patterns that merit further research. It is important to know the perceptions of Certified Athletic Trainers in regards to lower limb injuries that occur on artificial turf versus natural grass because they will provide an unbiased opinion that will determine if further research is necessary.

Definition of Terms

The following terms will be operationally defined for this study:

1) Collegiate Athletic Trainer – Individuals that are identified by the National Athletic Trainers' Association as working in a collegiate environment.
2) Artificial Turf – Any outdoor field surface that is manufactured with synthetic fibers to look like natural grass.
3) Natural Grass – Any outdoor surface that consists of grass that is imbedded into soil.
4) Primary Sport- The sport that an athletic trainer spends a majority of their time with.

Basic Assumptions

The following are basic assumptions of this study:

1) All survey questions were answered honestly, unbiased, and to the best of the ability of the athletic trainer.
2) No other individuals, except the participants will be completing the survey at their own free will.

3) The sample obtained for research best represents the athletic training population as a whole.
4) All participants are Certified Athletic Trainers' identified by the NATA.

Limitations of the Study

The following are possible limitations of the study:

1) The quality of natural grass surfaces may vary based on climatic changes.
2) The participants may not know what type of field surface their institution has.
3) Not all Certified Athletic Trainers' surveyed work with an outdoor sport as their primary sport coverage.
4) The email address for the selected participants may no longer be valid.
5) The participants may no longer work in a collegiate setting.

Delimitation of the Study

The following statement reflects the delimitations of the study:

1) Only collegiate athletic trainers will be surveyed.

2) All artificial turf types will be grouped together due to the vast amount of manufacturers.
3) The validity of the survey instrument has yet to be established.

Significance of the Study

The primary scope of this study is to examine the collegiate Certified Athletic Trainers' perceptions regarding the prevalence of lower limb injuries that occur on artificial turf versus natural grass. Knowing how athletic trainers perceive an increase in lower limb injuries that occur on artificial turf or natural grass may influence a collegiate institutions decision to install artificial turf or natural grass. In addition, based on the results of the study, further research may be deemed necessary to further look at the relationship between lower limb injuries and field surfaces.

APPENDIX C

Additional Methods

APPENDIX C1

Institutional Review Board –

California University of Pennsylvania

California University of Pennsylvania

Proposal Number

Date Received

PROTOCOL for Research Involving Human Subjects

Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects

(Reference IRB Policies and Procedures for clarification)

Project Title ***CERTIFIED ATHLETIC TRAINERS PERCEPTIONS OF LOWER LIMB INJURIES THAT OCCUR ON NATURAL GRASS VERSUS ARTIFICIAL TURF***

Researcher/Project Director ***Ryan JD Wildenhain***

Phone # ***815.354.5049*** ***E-mail Address*** ***wil4430@calu.edu***

Faculty Sponsor (if required) ***Dr. Thomas West***

Department ***Health Science***

Project Dates ***1/1/11*** ***to*** ***12/1/11***

Sponsoring Agent (if applicable) _____

Project to be Conducted at *Online survey conducted at California University of Pennsylvania*

Project Purpose: ☒ ***Thesis*** ☐ ***Research*** ☐ ***Class Project*** ☐ ***Other***

Keep a copy of this form for your records.

Approved, September 12, 2005 / (updated 02-09-09)

Please attach a typed, detailed summary of your project AND complete items 2 through 6.

1. *Provide an overview of your project-proposal describing what you plan to do and how you will go about doing it. Include any hypothesis(ses)or research questions that might be involved and explain how the information you gather will be analyzed. For a complete list of what should be included in your summary, please refer to Appendix B of the IRB Policies and Procedures Manual.*

The purpose of this study is to examine the perceptions athletic trainers have about lower limb injuries that occur on natural grass versus artificial turf.

The research design for this study will be descriptive as it will provide a summary of athletic trainers' opinions in regards to the relationship between sports surfaces and injury. The dependent variable will be the perceived relationship of lower limb injuries that occur on natural grass versus artificial turf by Certified Athletic Trainers. The independent variables include the athletic trainers' gender, years certified, NCAA Division, and playing surface. The strength of this study will be that there have not been any previous studies about the perception that athletic trainers have about the role natural grass and artificial turf play in lower limb injuries. A limitation to this study is that only using Certified Athletic Trainers from District 2, District 4, and District 7. Another limitation is the possibility that Certified Athletic Trainers may not know the exact type of playing surface they have at their institutions.

The participants for this study will be a random sample of Certified Athletic Trainers working in the collegiate setting from District 2, District 4, and District 7. All the participants in this study will be currently employed as a Certified Athletic Trainer with at least one of the following collegiate outdoor sports; male or female soccer, male or female lacrosse, male or female field hockey, and/ or football.

The survey was created by the primary researcher in consultation with thesis committee members. Following Institutional Review Board (IRB) approval, a pilot study will be conducted to confirm the reliability of the survey. The survey will be administered to 30 Certified Athletic Trainers who are currently working with the afore mentioned collegiate sports. After one week these ATC's will be surveyed a second time and reliability coefficients will be calculated for each question. Any questions demonstrating low correlation coefficients will either be revised or removed from the study.

The survey will be constructed by the researcher and distributed using Survey Monkey. The survey consistsof 2 primary sections. The first section contained demographics questions. The second section contained multiple pages of perception questions.

The study will be distributed through an email to the maximum amount of members from each of the following NATA (National Athletic Trainers' Association) districts; District 2, District 4, and District 7. To obtain email addresses the researcher will contact the district secretaries and request the maximum amount of random email addresses for individuals currently working as a collegiate athletic trainer. Informed consent will not required for this survey because completion of the survey implies consent. In addition, accompanying the survey will be a cover letter that explains the purpose of the study. A reminder email will be sent after the first week. After two weeks, a follow-up email will be sent to all participants who did not respond to survey. At the end of the third week a final email will be sent encouraging participants to complete the survey. Statistical data analysis began at the end of the fourth week.

The following hypotheses were based previous research and the researcher's intuition based on a review of the literature:

1. Athletic trainers will identify artificial turf to play a significant role in causing lower limb injuries when compared to natural grass.

2. There will be no difference in the perceptions of lower limb injuries that occur on artificial turf versus natural grass by athletic trainers in different NCAA divisions.

3. There will be no difference in the perceptions of lower limb injuries that occur on artificial turf versus natural grass by athletic trainers of different gender.

4. There will be no difference in the perceptions of lower limb injuries that occur on artificial turf versus natural grass based on how many years an athletic trainer has been certified.

2. *Section 46.11 of the Federal Regulations state that research proposals involving human subjects must satisfy certain requirements before the IRB can grant approval. You should describe in detail how the following requirements will be satisfied. Be sure to address each area separately.*

   a. *How will you insure that any risks to subjects are minimized? If there are potential risks, describe what will be done to minimize these risks. If there are risks, describe why the risks to participants are reasonable in relation to the anticipated benefits.*

      There are no foreseeable risks.

   b. *How will you insure that the selection of subjects is equitable? Take into account your purpose(s). Be sure you address research problems involving vulnerable populations such as children, prisoners, pregnant women, mentally disabled persons, and economically or educationally disadvantaged persons. If this is an in-class project describe how you will minimize the possibility that students will feel coerced.*

      All participants will be selected at random and will only include Certified Athletic Trainers from National Athletic Trainers' Associations District 2, District 4, and District 7. Participation to complete the survey will be at each Certified Athletic Trainers' own discretion.

   c. *How will you obtain informed consent from each participant or the subject's legally authorized representative and ensure that all consent forms are appropriately documented? Be sure to attach a copy of your consent form to the project summary.*

      An Informed Consent Form is not required for this on-line study.Consent will be implied upon participation of the survey.

   d. *Show that the research plan makes provisions to monitor the data collected to insure the safety of all subjects. This includes the privacy of subjects' responses and provisions for maintaining the security and confidentiality of the data.*

      Data will be collected during Spring semester. All subjects will be alloted 4 weeks to complete the survey. All collected data which will be maintained by the researcher in a secure location on campus which only the researcher and research advisor can access.

3. *Check the appropriate box(es) that describe the subjects you plan to use.*

☒ *Adult volunteers*	☐ *Mentally Disabled People*
☐ *CAL University Students*	☐ *Economically Disadvantaged People*
☐ *Other Students*	☐ *Educationally Disadvantaged People*
☐ *Prisoners*	☐ *Fetuses or fetal material*
☐ *Pregnant Women*	☐ *Children Under 18*
☐ *Physically Handicapped People*	☐ *Neonates*

4. *Is remuneration involved in your project?* ☐ *Yes or* ☒ *No. If yes, Explain here.*

5. *Is this project part of a grant?* ☐ *Yes or* ☒ *No* *If yes, provide the following information:*

   Title of the Grant Proposal _____

   Name of the Funding Agency _____

   Dates of the Project Period _____

6. *Does your project involve the debriefing of those who participated?* ☐ *Yes or* ☒ *No*

   If Yes, explain the debriefing process here.

7. *If your project involves a questionnaire interview, ensure that it meets the requirements of Appendix___in the Policies and Procedures Manual.*

California University of Pennsylvania Institutional Review Board
Survey/Interview/Questionnaire Consent Checklist (v021209)

This form MUST accompany all IRB review requests

Does your research involve ONLY a survey, interview or questionnaire?

☒ **YES**—Complete this form

☐ **NO**—You MUST complete the "Informed Consent Checklist"—skip the remainder of this form

Does your survey/interview/questionnaire cover letter or explanatory statement include:

☒ (1) Statement about the general nature of the survey and how the data will be used?

☒ (2) Statement as to who the primary researcher is, including name, phone, and email address?

☒ (3) FOR ALL STUDENTS: Is the faculty advisor's name and contact information provided?

☒ (4) Statement that participation is voluntary?

☒ (5) Statement that participation may be discontinued at any time without penalty and all data discarded?

☒ (6) Statement that the results are confidential?

☒ (7) Statement that results are anonymous?

☒ (8) Statement as to level of risk anticipated or that minimal risk is anticipated? (NOTE: If more than minimal risk is anticipated, a full consent form is required—and the Informed Consent Checklist must be completed)

☒ (9) Statement that returning the survey is an indication of consent to use the data?

☒ (10) Who to contact regarding the project and how to contact this person?

☒ (11) Statement as to where the results will be housed and how maintained? (unless otherwise approved by the IRB, must be a secure location on University premises)

☒ (12) Is there text equivalent to: "Approved by the California University of Pennsylvania Institutional Review Board. This approval is effective nn/nn/nn and expires mm/mm/mm"? (the actual dates will be specified in the approval notice from the IRB)?

☒ (13) FOR ELECTRONIC/WEBSITE SURVEYS: Does the text of the cover letter or explanatory statement appear before any data is requested from the participant?

☒ (14) FOR ELECTONIC/WEBSITE SURVEYS: Can the participant discontinue participation at any point in the process and all data is immediately discarded?

California University of Pennsylvania Institutional Review Board
Informed Consent Checklist (v021209)

This form MUST accompany all IRB review requests

Does your research involve ONLY a survey, interview, or questionnaire?
☒ **YES**—DO NOT complete this form. You MUST complete the "Survey/Interview/Questionnaire Consent Checklist" instead.
☐ **NO**—Complete the remainder of this form.

1. **Introduction** (check each)
   ☐ (1.1) Is there a statement that the study involves research?
   ☐ (1.2) Is there an explanation of the purpose of the research?

2. **Is the participant.** (check each)
   ☐ (2.1) Given an invitation to participate?
   ☐ (2.2) Told why he/she was selected.
   ☐ (2.3) Told the expected duration of the participation.
   ☐ (2.4) Informed that participation is voluntary?
   ☐ (2.5) Informed that all records are confidential?
   ☐ (2.6) Told that he/she may withdraw from the research at any time without penalty or loss of benefits?
   ☐ (2.7) 18 years of age or older? (if not, see Section #9, Special Considerations below)

3. **Procedures** (check each).
   ☐ (3.1) Are the procedures identified and explained?
   ☐ (3.2) Are the procedures that are being investigated clearly identified?
   ☐ (3.3) Are treatment conditions identified?

4. **Risks and discomforts**. (check each)
   ☐ (4.1) Are foreseeable risks or discomforts identified?
   ☐ (4.2) Is the likelihood of any risks or discomforts identified?
   ☐ (4.3) Is there a description of the steps that will be taken to minimize any risks or discomforts?
   ☐ (4.4) Is there an acknowledgement of potentially unforeseeable risks?
   ☐ (4.5) Is the participant informed about what treatment or follow up courses of action are available should there be some physical, emotional, or psychological harm?
   ☐ (4.6) Is there a description of the benefits, if any, to the participant or to others that may be reasonably expected from the research and an estimate of the likelihood of these benefits?
   ☐ (4.7) Is there a disclosure of any appropriate alternative procedures or courses of treatment that might be advantageous to the participant?

5. **Records and documentation**. (check each)
   ☐ (5.1) Is there a statement describing how records will be kept confidential?
   ☐ (5.2) Is there a statement as to where the records will be kept and that this is a secure location?
   ☐ (5.3) Is there a statement as to who will have access to the records?

6. For research involving more than minimal risk (check each),

☐ (6.1) Is there an explanation and description of any compensation and other medical or counseling treatments that are available if the participants are injured through participation?

☐ (6.2) Is there a statement where further information can be obtained regarding the treatments?

☐ (6.3) Is there information regarding who to contact in the event of research-related injury?

7. Contacts.(check each)

☐ (7.1) Is the participant given a list of contacts for answers to questions about the research and the participant's rights?

☐ (7.2) Is the principal researcher identified with name and phone number and email address?

☐ (7.3) FOR ALL STUDENTS: Is the faculty advisor's name and contact information provided?

8. General Considerations (check each)

☐ (8.1) Is there a statement indicating that the participant is making a decision whether or not to participate, and that his/her signature indicates that he/she has decided to participate having read and discussed the information in the informed consent?

☐ (8.2) Are all technical terms fully explained to the participant?

☐ (8.3) Is the informed consent written at a level that the participant can understand?

☐ (8.4) Is there text equivalent to: "Approved by the California University of Pennsylvania Institutional Review Board. This approval is effective nn/nn/nn and expires mm/mm/mm"? (the actual dates will be specified in the approval notice from the IRB)

9. Specific Considerations (check as appropriate)

☐ (9.1) If the participant is or may become pregnant is there a statement that the particular treatment or procedure may involve risks, foreseeable or currently unforeseeable, to the participant or to the embryo or fetus?

☐ (9.2) Is there a statement specifying the circumstances in which the participation may be terminated by the investigator without the participant's consent?

☐ (9.3) Are any costs to the participant clearly spelled out?

☐ (9.4) If the participant desires to withdraw from the research, are procedures for orderly termination spelled out?

☐ (9.5) Is there a statement that the Principal Investigator will inform the participant or any significant new findings developed during the research that may affect them and influence their willingness to continue participation?

☐ (9.6) Is the participant is less than 18 years of age? If so, a parent or guardian must sign the consent form and assent must be obtained from the child

- ☐Is the consent form written in such a manner that it is clear that the parent/guardian is giving permission for their child to participate?
- ☐Is a child assent form being used?
- ☐ Does the assent form (if used) clearly indicate that the child can freely refuse to participate or discontinue participation at any time without penalty or coercion?

☐ (9.7) Are all consent and assent forms written at a level that the intended participant can understand? (generally, 8th grade level for adults, age-appropriate for children)

California University of Pennsylvania Institutional Review Board
Review Request Checklist (v021209)

This form MUST accompany all IRB review requests.
Unless otherwise specified, ALL items must be present in your review request.

Have you:

☒ (1.0) FOR ALL STUDIES: Completed ALL items on the Review Request Form?
Pay particular attention to:

- ☒ (1.1) Names and email addresses of all investigators
  - ☒ (1.1.1) FOR ALL STUDENTS: use only your CalU email address)
  - ☒ (1.1.2) FOR ALL STUDENTS: Name and email address of your faculty research advisor
- ☒ (1.2) Project dates (must be in the future—no studies will be approved which have already begun or scheduled to begin before final IRB approval—NO EXCEPTIONS)
- ☒ (1.3) Answered completely and in detail, the questions in items 2a through 2d?
  - ☒2a: NOTE: No studies can have zero risk, the lowest risk is "minimal risk". If more than minimal risk is involved you MUST:
    - ☐ i. Delineate all anticipated risks in detail;
    - ☐ ii. Explain in detail how these risks will be minimized;
    - ☐ iii. Detail the procedures for dealing with adverse outcomes due to these risks.
    - ☐ iv. Cite peer reviewed references in support of your explanation.
  - ☒ 2b. Complete all items.
  - ☒ 2c. Describe informed consent procedures in detail.
  - ☒ 2d. NOTE: to maintain security and confidentiality of data, all study records must be housed in a secure (locked) location ON UNIVERSITY PREMISES. The actual location (department, office, etc.) must be specified in your explanation and be listed on any consent forms or cover letters.
- ☒ (1.4) Checked all appropriate boxes in Section 3? If participants under the age of 18 years are to be included (regardless of what the study involves) you MUST:
  - ☒ (1.4.1) Obtain informed consent from the parent or guardian—consent forms must be written so that it is clear that the parent/guardian is giving permission for their child to participate.
  - ☒ (1.4.2) Document how you will obtain assent from the child—This must be done in an age-appropriate manner. Regardless of whether the parent/guardian has given permission, a child is completely free to refuse to participate, so the investigator must document how the child indicated agreement to participate ("assent").
- ☒ (1.5) Included all grant information in section 5?
- ☒ (1.6) Included ALL signatures?

☐ (2.0) FOR STUDIES INVOLVING MORE THAN JUST SURVEYS, INTERVIEWS, OR QUESTIONNAIRES:

- ☐ (2.1) Attached a copy of all consent form(s)?
- ☐ (2.2) FOR STUDIES INVOLVING INDIVIDUALS LESS THAN 18 YEARS OF AGE: attached a copy of all assent forms (if such a form is used)?
- ☐ (2.3) Completed and attached a copy of the Consent Form Checklist? (as appropriate—see that checklist for instructions)

☒ (3.0) FOR STUDIES INVOLVING ONLY SURVEYS, INTERVIEWS, OR QUESTIONNAIRES:

- ☒ (3.1) Attached a copy of the cover letter/information sheet?
- ☒ (3.2) Completed and attached a copy of the Survey/Interview/Questionnaire Consent Checklist? (see that checklist for instructions)
- ☒ (3.3) Attached a copy of the actual survey, interview, or questionnaire questions in their final form?

☒ (4.0) FOR ALL STUDENTS: Has your faculty research advisor:

- ☒ (4.1) Thoroughly reviewed and approved your study?
- ☒ (4.2) Thoroughly reviewed and approved your IRB paperwork? including:
  - ☒ (4.2.1) Review request form,
  - ☐ (4.2.2) All consent forms, (if used)
  - ☐ (4.2.3) All assent forms (if used)
  - ☒ (4.2.4) All Survey/Interview/Questionnaire cover letters (if used)
  - ☒ (4.2.5) All checklists
- ☒ (4.3) IMPORTANT NOTE: Your advisor's signature on the review request form indicates that they have thoroughly reviewed your proposal and verified that it meets all IRB and University requirements.

☒ (5.0) Have you retained a copy of all submitted documentation for your records?

Project Director's Certification

Program Involving HUMAN SUBJECTS

The proposed investigation involves the use of human subjects and I am submitting the complete application form and project description to the Institutional Review Board for Research Involving Human Subjects.

I understand that Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects. If the Board grants approval of this application, I agree to:

1. Abide by any conditions or changes in the project required by the Board.
2. Report to the Board any change in the research plan that affects the method of using human subjects before such change is instituted.
3. Report to the Board any problems that arise in connection with the use of human subjects.
4. Seek advice of the Board whenever I believe such advice is necessary or would be helpful.
5. Secure the informed, written consent of all human subjects participating in the project.
6. Cooperate with the Board in its effort to provide a continuing review after investigations have been initiated.

I have reviewed the Federal and State regulations concerning the use of human subjects in research and training programs and the guidelines. I agree to abide by the regulations and guidelines aforementioned and will adhere to policies and procedures described in my application. I understand that changes to the research must be approved by the IRB before they are implemented.

Professional Research

Project Director's Signature

Department Chairperson's Signature

Student or Class Research

Student Researcher's Signature

Supervising Faculty Member's Signature if required

Department Chairperson's Signature

ACTION OF REVIEW BOARD (IRB use only)

The Institutional Review Board for Research Involving Human Subjects has reviewed this application to ascertain whether or not the proposed project:

1. provides adequate safeguards of the rights and welfare of human subjects involved in the investigations;
2. uses appropriate methods to obtain informed, written consent;
3. indicates that the potential benefits of the investigation substantially outweigh the risk involved.
4. provides adequate debriefing of human participants.
5. provides adequate follow-up services to participants who may have incurred physical, mental, or emotional harm.

☐ Approved[_____] ☐ Disapproved

Chairperson, Institutional Review Board

Date

Approved, September 12, 2005 / (updated 02-09-09)

Institutional Review Board
California University of Pennsylvania
Psychology Department LRC, Room 310
250 University Avenue
California, PA 15419
instreviewboard@cup.edu
instreviewboard@calu.edu
Robert Skwarecki, Ph.D., CCC-SLP,Chair

Mr. Wildenhain

Please consider this email as official notification that your proposal titled Certified Athletic Trainers Perceptions of Lower Limb Injuries that Occur on Natural Grass versus Artificial Turf" (Proposal #10-032) has been approved by the California University of Pennsylvania Institutional Review Board as submitted.

The effective date of the approval is 02-15-2011 and the expiration date is 02-14-2012. 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 02-14-2012 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 C2

Survey

1. Cover Letter

Dear Fellow Certified Athletic Trainer,

I am a master's degree candidate at California University of Pennsylvania, requesting your assistance to complete part of my degree requirements. The primary purpose of this study is to examine the perceptions athletic trainers have about lower limb injuries that occur on natural grass versus artificial turf.

This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA's commitment to athletic training education and research.

The questionnaire consists of two sections. The first section is comprised of demographic questions and the second section contains perception questions as they pertain to lower limb injuries that occur on artificial turf versus natural grass.

A random sample of 1000 Certified Athletic Trainers' working in the collegiate setting from the National Athletic Trainers' Association have been asked to take part in this survey. The California University of Pennsylvania Institutional Review Board has approved this study for the Protection of Human Subjects effective 02/15/2011 until 02/14/2012. Completion of the online survey constitutes informed consent to participate in this study.

Participation within this survey is voluntary. This survey is completely anonymous and upon submission, neither your name nor email address will be attached to your answers. Your information will be kept strictly confidential. Further, you will have the option to discontinue taking the survey at any time without penalty and all data will be discarded.

If at any time you have questions or concerns about the survey you can contact the researcher by email at wil4430@calu.edu or by telephone at 815.354.5049. If you would like to contact the research advisor, his name is Tom West and can be contacted by email at west_t@calu.edu or by telephone at 724.938.5933.

As a fellow certified athletic trainer, your knowledge and opinions regarding this topic makes your input invaluable.

Thank you for your time and consideration,

Ryan JD Wildenhain, ATC, PES
Graduate Athletic Training Education Program
California University of Pennsylvania
250 University Avenue
California, Pennsylvania 15419

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

2. Definitions

Primary Sport- The sport that an athletic trainer spends a majority of their time with.

Artificial Turf – Any outdoor field surface that is manufactured with synthetic fibers to look like natural grass.

Natural Grass – Any outdoor surface that consists of grass that is imbedded into soil.

Acute Injury- An injury that is the result of a specific impact or traumatic event to the body and may require immediate medical attention

Chronic Injury- An injury that is usually the result from overusing one area of the body while playing a sport or exercising over a long period of time

3. Demographics

1. Are you currently working in the collegiate setting?

- ◯ Yes
- ◯ No

4.

1. Do you work with an outdoor sport?

- ◯ Yes
- ◯ No

5.

1. What is your gender?

- ◯ Male
- ◯ Female

2. How many years have you been recognized as a Certified Athletic Trainer by the Board of Certification?

- ◯ 1-5
- ◯ 6-10
- ◯ 11-15
- ◯ 16-20
- ◯ 21-25
- ◯ 25-30
- ◯ 31+
- ◯ Not Certified

3. Which National Athletic Trainers' Association (NATA) district are you associated with?

- ◯ District 1: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
- ◯ District 2: Delaware, New Jersey, New York, Pennsylvania
- ◯ District 3: District of Columbia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
- ◯ District 4: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
- ◯ District 5: Iowa, Kansas, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota
- ◯ District 6: Arkansas, Texas
- ◯ District 7: Arizona, Colorado, New Mexico, Utah, Wyoming
- ◯ District 8: California, Hawaii, Nevada
- ◯ District 9: Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, Tennessee
- ◯ District 10: Alaska, Idaho, Montana, Oregon, Washington

4. What is your primary outdoor sport coverage? Please answer the remainder of the questions based on this selection as your primary outdoor sport. Please choose one sport if you spend an equal amount of time with multiple sports.

- ◯ Football
- ◯ Mens Soccer
- ◯ Mens Lacrosse
- ◯ Mens Field Hockey
- ◯ Womens Soccer
- ◯ Womens Lacrosse
- ◯ Womens Field Hockey
- ◯ Other (please specify)

5. What collegiate division is your primary outdoor sport associated with?

- ◯ NCAA Division I
- ◯ NCAA Division II
- ◯ NCAA Division III
- ◯ NAIA Division I
- ◯ NAIA Division II
- ◯ Other (please specify)

6. Natural Grass versus Artificial Turf

Please read all questions carefully.

1. From your experiences with your primary outdoor sport, on which type of field surface do you believe more ACUTE NON-CONTACT lower limb injuries occur?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

2. From your experiences with your primary outdoor sport, on which type of field surface do you believe more ACUTE CONTACT lower limb injuries occur?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

3. From your experiences with your primary outdoor sport, on which type of field surface do you believe more CHRONIC lower limb injuries occur?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

4. During rainy weather, on which field surface do you feel is SAFER for athletes to practice or compete?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

5. During snowy weather, on which field surface do you feel is SAFER for athletes to practice or compete?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

6. During cold weather, on which field surface do you feel is SAFER for athletes to practice or compete?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

7. Overall, which type of field surface do you believe is SAFER in regards to lower limb injuries?

- ◯ Natural Grass
- ◯ Artificial Turf
- ◯ No Difference

8. Do you know what type of field surface your primary sport utilizes during practice?

- ◯ AstroTurf
- ◯ FieldTurf
- ◯ Natural Grass
- ◯ I do not know
- ◯ Other (please specify)

9. Do you know what type of field surface your primary sport utilizes during games?

- ◯ AstroTurf
- ◯ FieldTurf
- ◯ Natural Grass
- ◯ I do not know
- ◯ Other (please specify)

10. What is the condition of your field surface?

- ◯ Excellent (Brand new or minimal deterioration)
- ◯ Good (Beginning to show deterioration)
- ◯ Poor (Has a lot of deterioration)

7. Injury Risk

The following questions will help determine the perceived risk of lower limb injuries that occur on natural grass compared to artificial turf.

1. In regards to your primary outdoor sport, on which field surface do you believe the following injuries OCCUR MORE OFTEN?

	Natural Grass	Artificial Turf	No Difference
Turf Toe	◯	◯	◯
Jones Fracture	◯	◯	◯
Lateral Ankle Sprain	◯	◯	◯
Medial Ankle Sprain	◯	◯	◯
High Ankle Sprain	◯	◯	◯
Shin Splints	◯	◯	◯
ACL Non-Contact Injuries	◯	◯	◯
ACL Contact Injuries	◯	◯	◯
MCL Non-Contact Injuries	◯	◯	◯
MCL Contact Injuries	◯	◯	◯
LCL Non-Contact Injuries	◯	◯	◯
LCL Contact Injuries	◯	◯	◯
Meniscal Injuries	◯	◯	◯
Hip Injuries	◯	◯	◯
Lower Back Injuries	◯	◯	◯
Tibia-Fibula Stress Fracture	◯	◯	◯

Other (please specify injury and field surface)

8. Injury Risk

1. Please rate the percieved risk of lower limb injuries that occur on artificial turf when compared to natural grass.

	Significantly Lower Risk	Moderately Lower Risk	Same Amount of Risk	Moderately Higher Risk	Significantly Higher Risk
Foot Injuries	◯	◯	◯	◯	◯
Ankle Injuries	◯	◯	◯	◯	◯
Knee Injuries	◯	◯	◯	◯	◯
Hip Injuries	◯	◯	◯	◯	◯
Back Injuries	◯	◯	◯	◯	◯

Other (please specify body region and risk level)

2. Which of the following preventive measures have you implemented while supervising your primary sport? (Choose all that apply)

- ☐ Recommended proper footwear to athletes based on the field surface
- ☐ Inspected field for irregularities
- ☐ Acclimated a team or individual to a new field surface
- ☐ Other (please specify)

9. Thank you.

Thank you for your participation. Your time and effort is greatly appreciated. Please direct any questions or feedback you may have to the primary researcher listed below.

Ryan Wildenhain, ATC, PES
California University of Pennsylvania
250 University Ave
California, PA 15419
wil4430@calu.edu
815-354-5049

If you would like more information about the Graduate Athletic Training Program at CalU please go to http://www.calu.edu/academics/graduate-programs/athletic-training/index.htm.

APPENDIX C3

Cover Letter

Dear Fellow Certified Athletic Trainer,

I am a master's degree candidate at California University of Pennsylvania, requesting your assistance to complete part of my degree requirements. The primary purpose of this study is to examine the perceptions athletic trainers have about lower limb injuries that occur on natural grass versus artificial turf.

This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA's commitment to athletic training education and research.

The questionnaire consists of two sections. The first section is comprised of demographic questions and the second section contains perception questions as they pertain to lower limb injuries that occur on artificial turf versus natural grass.

A random sample of 1000 Certified Athletic Trainers' working in the collegiate setting from the National Athletic Trainers' Association have been asked to take part in this survey. The California University of Pennsylvania Institutional Review Board has approved this study for the Protection of Human Subjects effective 02/14/2011 until 02/15/2012. Completion of the online survey constitutes informed consent to participate in this study.

Participation within this survey is voluntary. This survey is completely anonymous and upon submission, neither your name nor email address will be attached to your answers. Your information will be kept strictly confidential. Further, you will have the option to discontinue taking the survey at any time without penalty and all data will be discarded.

If at any time you have questions or concerns about the survey you can contact the researcher by email at wil4430@calu.edu or by telephone at 815.354.5049. If you would like to contact the research advisor, his name is Tom West and can be contacted by email at west_t@calu.edu or by telephone at 724.938.5933.

As a fellow certified athletic trainer, your knowledge and opinions regarding this topic makes your input invaluable. Please take a few minutes to complete the survey by clicking on the link below.
https://www.surveymonkey.com/s/8VL8JB9

Thank you for your time and consideration,

Ryan JD Wildenhain, ATC, PES
Graduate Athletic Training Education Program
California University of Pennsylvania
250 University Avenue
California, Pennsylvania 15419

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

APPENDIX C4

Pilot Study Results

Table 19: Pearson Product Moment Correlation for Pilot Study Results

Question #	Pearson Correlation	Significance
Q13	.111	.745
Q14	.049	.886
Q15	.090	.793
Q16	.000	1.000
Q17	.570	.067
Q18	.734	.010
Q19	.510	.109
Q20	-.418	.200
Q22	-.179	.599
Q24	.467	.148
Q25	.707	.015
Q26	.690	.019
Q27	.719	.013
Q28	.517	.103
Q29	.575	.064
Q30	.538	.088
Q31	.266	.429
Q32	.329	.324
Q33	.442	.173
Q34	.405	.216
Q35	.337	.311
Q36	.329	.324
Q37	.705	.015
Q38	.064	.852
Q39	.467	.148

REFERENCES

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Abstract

Title:	CERTIFIED ATHLETIC TRAINERS PERCEPTIONS OF LOWER LIMB INJURIES THAT OCCUR ON NATURAL GRASS VERSUS ARTIFICIAL TURF
Researcher:	Ryan J.D. Wildenhain, ATC, NASM-PES
Advisor:	Thomas F. West, PhD, ATC
Date:	April 2011
Research Type:	Master's Thesis
Context:	There have been conflicting reports about whether artificial turf impacts lower limb injuries more compared to natural grass. Some research shows artificial turf to be safer while others have found it to be unsafe or have no difference compared to artificial turf.
Objective:	The primary scope of this study is to determine if Certified Athletic Trainers' (ATC's) in the collegiate setting perceive a difference in lower limb injuries that occur on artificial turf versus natural grass.
Design:	Descriptive Survey
Setting:	Population-Based Survey
Participants:	1000 randomly selected ATC's currently working in the collegiate setting. The final response rate was 269 with 163 utilized for data analysis.
Interventions:	The dependent variable was the perceived relationship of lower limb injuries that occur on natural grass versus artificial turf by ATC'S. The independent variables included an Athletic Trainers' gender, years certified, collegiate governing body affiliation, and playing surface.

Main Outcome Measures: Perceived risk was measured with the following scale: -2= Significantly Lower Risk, -1= Moderately Lower Risk, 0= Same Amount of Risk, 1=Moderately Higher Risk, 2=Significantly Higher Risk.

Results: The overall perceived mean risk score of .199 was considered insignificant. The significance level from a one-way ANOVA between ATC's overall perceived mean risk score and a collegiate governing body was deemed insignificant at .685. A t-test was calculated comparing the mean risk scores between male Certified Athletic Trainers' and female Certified Athletic Trainers'. The results of the t-test showed the .056 significance level to be insignificant. A one-way ANOVA determined the number of years and Athletic Trainer to be certified did not play a role in altering their perceptions of lower limb injuries that occur on natural grass versus artificial turf. The significance level for this one-way ANOVA was .289.

Conclusion: There were no significant differences found between Certified Athletic Trainers' from different collegiate governing bodies, gender, years certified, NATA Districts, and sports. Based on the results of this study, we can conclude that Certified Athletic Trainers' have similar perceptions of lower limb injuries that occur on natural grass versus artificial turf.

Word Count: 374