DIFFERENCE IN DRUMMING SPEED OF VARIOUS SKILL LEVELS DEPENDENT UPON WARM-UP PROTOCOLS

A THESIS

Submitted to the Faculty of the School of Graduate Studies and Research
of
California University of Pennsylvania in partial fulfillment of the requirements for the degree of

Master of Science

by
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California, Pennsylvania
2010

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ACKNOWLEDGEMENTS

I would like to take this time to thank all the people who had a part, directly or indirectly, in making this project a reality.

First off, thank you to my committee, Thomas F. West, PhD, ATC (Chair), Marty Sharer, PhD, and Jodi Dusi, MPT. Your time spent in helping me create this unique thesis is truly appreciated.

Secondly, thank you to all my subjects who were willing to put in the hours needed for me to complete this project. Without your effort I would not have graduated.

I would also like to thank my family. Thank you for your constant support and prayer. Life is full of surprises!

I also want to say thanks to DreadHeadHQ for their sponsorship. It is great to be on your team, thank you for all the exposure you have given me.

Lastly, thank you to South Hills Bible Chapel for consistently giving me a place to play percussion and to Risen Drums for my amazing custom purpleheart snare drum.

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INTRODUCTION

During the past decade, previously unmet medical needs of performing artists have fostered the rise of a new medical subspecialty: performing arts medicine.[1] The increasing number of reported performance-related injuries plays a part in this as well as the willingness of musicians to seek medical attention. As with athletes, the demands and stress on the performing musician is very high. The combination of speed, coordination, accuracy, consistency and timing create a situation in which injuries impede the successful performance by the musician.

While musicians are becoming more willing to seek medical attention, there are still several factors that keep musicians from seeking medical care.[1] The first is the absence of highly visible signs of injury. Most injuries of musicians are not as overt as typical athletic injuries, therefore, musicians do not seek care as readily as athletes.[1] Second, musicians are often told that discomfort is inevitable. Third, musicians also often feel that the injury is their fault due to the stresses they are putting on their body. Fourth, musicians fear the risk of loss of

employment due to inability to play. Lastly, musicians can be reluctant because of the belief that treatment will change their technique on their instrument. While these factors are understandable, they can be associated with a lack of information or misinformation about performing arts medicine. Seeking help from a sports medicine specialist may help prevent injuries and decrease the amount of time the musician loses because of an injury. This is especially true for percussionists, because their whole body is involved in playing their instrument.

A number of conclusions can be drawn regarding the effects of warm-ups on drumming performance.[2] First there are two types of warm-ups, active and passive. Active warm-ups involve exercise and are likely to induce greater metabolic and cardiovascular changes than passive warm-ups. Passive warm-ups involve raising the muscle temperature or core temperature by some external means (hot pack, hot shower, etc.).[2] The first conclusion that can be drawn is that active warm-ups tend to result in slightly larger improvements in short-term performance (less than 10 seconds) compared to passive heating alone. However, short-term performance may be impaired if the warm-up is too intense or does not allow sufficient recovery and results in a decreased availability of high energy

phosphates before starting the task.[3] Active warm-ups have also been shown to improve both long-term and intermediate performance (greater than 10 seconds and less than 5 minutes) if it allows the athlete to begin the subsequent task in a relative non-fatigued state, but with an elevated VO_2. While passive warm-ups have shown to improve immediate performance, both passive and active warm-ups may have detrimental effects on endurance performance.[2] By manipulating intensity, duration and recovery, many different warm-up protocols may be able to achieve similar physiological and performance changes.[2]

While a number of physiological effects of a warm-up have been attributed to temperature-related mechanisms, other mechanisms have also been proposed (e.g. effects of acidemia, mobilization of the aerobic system and increased postactivation potentiation). Despite the above mentioned mechanisms, it appears that passive warm-up does not improve isometric force, but may improve short-duration (<10 seconds) dynamic force. There are improvements in dynamic short-term performance (e.g. vertical jumping and sprint cycling) that tend to be less than those reported for isolated muscles.[4] While the mechanisms remain to be fully elucidated, it also appears that passive warm-up can improve intermediate performance (~10 seconds to 5

minutes). Passive warm-up does not improve, and may have a detrimental effect on long-term performance (>5 minutes), possibly via an increase in thermoregulatory strain.[4] There are several protocols that may help improve warm-ups, and ultimately, performance and possibly reduce injury.

There are conflicting views in regards to what is the best way to reduce injury.[5] A study was performed to see if a warm-up and stretching can prevent or reduce muscular injury. Subjects studied included both male and female and trained and untrained individuals. The independent variable was the warm-up and the dependent variable was the number of injuries. The results showed contradictory evidence to the question above. In the end, there is not enough evidence to answer whether or not a warm-up or stretching can prevent muscular injury in drumming. If a drummer chooses to use a warm-up, it should be implemented prior to physical activity. Ideally, it should occur about 15 minutes prior to the activity and be tailored to the individual as well as the activity. This includes the elbow, forearm and wrist. It should produce a mild sweat, but avoiding fatigue.[2]

To understand how high levels of skill are developed and maintained, it is necessary to study elite groups such as professional athletes or musicians.[6] A study was

performed in which subjects included musicians and non-musicians. The independent variable is the musician playing at a high level. The dependent variable is the cortical activation. The results showed that being a very skilled musician can structurally change the motor areas of the brain.

Philosophy, methodology and techniques are required to obtain greater performance on the drums with both hands and feet.[7] A study was done that included drummers who wanted to gain greater speed with their hands and feet. The independent variables were proper biomechanical alignment of limbs, proper technique and all equipment properly aligned. The dependent variable was the speed. The results showed that by manipulating the independent variables, drummers can increase speed with their hands and feet. Subsequently, speed of drumming appears to be impacted by proper body mechanics and techniques, suggesting that warm-up protocols that impact posture and drumming technique may significantly improve speed. The purpose of this study is to examine the different effects of warm-up protocols on various skill levels while performing a single stroke roll. In the end, there is insufficient evidence to answer whether or not a warm-up/stretching can prevent muscular injury, but there is

research that shows the potential for an increase in performance. If a warm-up is performed, it should be implemented prior to physical activity. Ideally, it should occur about 15 minutes prior to the activity and be tailored to the individual as well as the activity.

METHODS

The purpose of this study was to examine the difference in maximal drumming speed of various skill levels dependent upon warm-up protocols. The following areas are discussed in this section: Research Design, Subjects, Preliminary Research, Instruments, Procedures, Hypotheses, and Data Analysis.

Research Design

A within subjects quasi-experimental design was used for this study. One independent variable of this study was the warm-up protocols: heat, stretching and rudiments. The other independent variable was the skill of the drummer: novice, amateur and professional. The dependent variable of this study was the amount of strikes on the pad in one minute. On the first day, baseline drum testing was performed. On the following days, a warm-up protocol was performed followed by drum testing.

Subjects

The subjects (N=15) of this study were male and female drummers from California University of Pennsylvania. All subjects read and signed an informed consent form (Appendix C1) prior to participating in the study. Subjects who had current upper body injuries, or were currently taking medications that may have affected their ability to strike the pad were excluded from the study. Demographic information was obtained from the Demographic Profile Form (Appendix C2) that each subject filled out prior to participation. A Photo Consent Form was also filled out prior to participation (Appendix C3).

Preliminary Research

The purpose of the preliminary research was to familiarize the researcher with the instruments and warm-up protocols that were used in this study. This included familiarization with the Drumometer Model II, warm-up protocols and the testing protocol. The preliminary research also aided the researcher in deciding the amount of rest time needed in-between each test trial. In addition, the preliminary research allowed the researcher

to determine the amount of time required for each day of testing. The preliminary subject (N=1) was a volunteer drummer from California University of Pennsylvania. The preliminary subject was randomly assigned to one of the three previously mentioned warm-up protocols. This allowed for the researcher to carry out the procedures for each group, ensuring proper execution of each protocol.

Instruments

The following instruments were used in this study: a subject demographic profile form (Appendix C2), a heat warm-up protocol, a stretching warm-up protocol, a rudiment warm-up protocol (Appendix C4), a Drumometer Model II strike counter (Figure 1) and a pair of Vic Firth SD1 General drumsticks (Figure 2) and the data collection sheet (Appendix C5).

Subject Demographic Profile Form

The Subject Demographic Profile Form (Appendix C2) was created by the researcher. The demographic profile included age, years of experience, years of studying, specialty, hours of practicing a week, and upper body injury history. The Demographic Profile Form helped to

confirm that subjects did not have any current upper body injuries, or if there were on any medications that may have affected their ability to strike a pad. If volunteers answered yes to any of the questions on the Demographic Profile Form, they were excluded from the study.

Heat Warm-up Protocol

Based on the results of the research, thermotherapy treatment of the upper extremity have effects on the performance of the hand expressed as reaction time, speed of movement and tapping speed.[8] A study performed by Bishop showed that a majority of the effects of a warm-up are due to a temperature-related mechanism.[4] For the purpose of this study, a hot pack from a hydrocollator that is between 160-176 degrees Fahrenheit will be applied to the top and bottom of forearms, wrists and elbows. The treatment will be applied for 12 minutes.

Stretching Warm-up Protocol

Common clinical practices suggest that pre-exercise stretching can enhance performance and prevent injuries by increasing flexibility. For the purpose of this study, the wrist and forearm flexors and extensors were stretched as well as finger flexors. Three stretches were performed in

each motion. Stretches were held for thirty seconds each. They were completed on the left and right hand.

Rudiment Warm-up Protocol

Often called the 'building blocks of drumming' and equated with the scales played on melodic instruments, drum rudiments consist of short rhythmic phrases with specific stickings.[9] For the purpose of this study, the 13 essential rudiments will be used as described by the National Association of Rudimental Drummers (Appendix C4). Each rudiment will be performed for 30 seconds with a rest time of 5 seconds in between. This protocol will take 7 minutes and 35 seconds.

Drumometer Model II

The Drumometer Model II works when the pad that is being struck sends an electric signal to the Drumometer. When the pad is struck, the timer will immediately start counting down and the counter will record each stroke until the desired time has elapsed (in this study 60 seconds will be used). When the timer reaches zero, the Drumometer will stop and an alarm will sound. The number of strokes that has been played in a minute will be displayed and recorded.

Figure 1. Drumometer Model II

Vic Firth SD1 General Drumsticks

The Vic Firth SD1 General drumsticks are very versatile drumsticks. They have a length of 16 3/8″ and a width of .635″. All subjects utilized these drumsticks while testing.

Figure 2. Vic Firth SD1 General Drumsticks

Data Collection Sheet

The Data Collection Sheet (Appendix C5), created by the researcher was used to record all relevant data for the test using the Drumometer Model II. This included the subject identification number, group assignment, date, warm-up protocol, and the results of the three trials from day one, two, three and day four of testing.

Procedures

The following steps were taken for this study: approval to carry out the study was acquired from the California University of Pennsylvania Institutional Review

Board (Appendix C6). Once the study was approved, preliminary research was conducted. After completion of preliminary research, subjects were sought to participate in the study. California University of Pennsylvania drummers were asked to volunteer to participate in the study. Subjects were educated on the details and purpose of the study. Prior to participation all volunteers were given an informed consent form to read and sign. All participants then scheduled four testing times: the first to obtain baseline data and a second through fourth to carry out their randomly assigned warm-up protocols.

When subjects arrived on the first day they picked a number out of a box to obtain their randomly assigned subject number and group designation. The assigned subject number replaced the subject's name once testing began to maintain subject anonymity. After receiving their subject number, the subjects completed the previously mentioned demographic profile form. Volunteers who revealed any current injuries or contraindications were not allowed to participate in the study. Subjects then completed one practice trial using the Drumometer Model II strike counter before they performed their actual test. The practice trial was carried out to allow the subject to familiarize themselves with the Drumometer Model II. After the

practice trial was completed, the subject completed the actual test. The actual test consists of three attempts with the Drumometer Model II in which the highest score was recorded. Based on observations from the preliminary research, subjects were allowed a three minute rest period between trials. The result from the official test was considered their baseline data. Results were recorded in the data collection sheet.

After a minimum of one day and a maximum of seven days passed and to minimize a possible learning affect, the subjects returned for day two of testing. When subjects arrived on the second day they were instructed on how to perform the warm-up protocol assigned to them. They then completed their designated warm-up protocol: heat, stretching or rudiments. Once the subjects completed their appointed warm-up, they completed their three tests on the Drumometer Model II and the best result was recorded.

After a minimum of one day and a maximum of seven days passed, the subjects returned for day three of testing. When subjects arrived on the second day they were instructed on how to perform the warm-up protocol that was randomly assigned to them. They then completed their designated warm-up protocol: heat, stretching or rudiments. Once the subjects completed their appointed warm-up, they

completed their tests on the Drumometer Model II. Results of the official test were recorded.

After a minimum of one day and a maximum of seven days passed, the subjects returned for day four of testing. When subjects arrived on the second day they were instructed on how to perform the warm-up protocol assigned to them. They then completed their designated warm-up protocol: heat, stretching or rudiments. Once the subjects completed their appointed warm-up, they completed their test on the Drumometer Model II. Results of the official test were recorded.

Hypotheses

The following hypotheses were generated based on the literature review and the clinical intuition of the researcher.

1. There will be a difference in maximal drumming speed dependent upon warm-up protocols.
2. There will be a difference in maximal drumming speed dependent upon skill level.
3. There will be an interactive effect between warm-up protocol and skill level upon maximal drumming speed.

Data Analysis

A 3 x 3 factorial ANOVA (analysis of variance) was used to determine the effect of the independent variables (type of warm-up protocol and skill level) on the dependent variable (strikes per minute). This will examine both the main effects and the interaction. If a difference is found, post hoc testing was to be conducted to analyze the patterns. The dependent variable, strikes per minute, was used to calculate a difference in the warm-up protocols. This was calculated by subtracting the day 1 baseline test from the day 2, day 3 and day 4 test score. An alpha level of $P \leq 0.05$ was used to determine statistical significance. SPSS 17.0 was used for this statistical analysis.

RESULTS

The purpose of this study was to examine the difference in maximal drumming speed of various skill levels dependent upon warm-up protocols. The following section contains the data collected through the study and is divided into three subsections: Demographic Information, Hypotheses Testing and Additional Findings.

Demographic Information

Subjects included volunteer drummers who were students at California University of Pennsylvania. There were 3 beginners, 4 intermediate and 8 advanced drummers. Participants indicated three main areas of focus; 6 were specialized in drum set, 8 were specialized in drumline and 1 was specialized in the hammered dulcimer.

Hypothesis Testing

Mean drumming speed of the three participant skill levels under the three warm-up conditions can be found in table 2. The following hypotheses were tested in this study and determined if the main effect of skill level and warm-up had a significant effect on performance. All hypotheses were tested with a level of significance set at $\alpha \leq 0.05$. Differences were examined utilizing one 3 x 3 factorial ANOVA with repeated measures for the effect of various warm-ups on maximal drumming speed of various skill levels. Interactions between the independent variables of warm-up and skill levels were also examined.

Hypothesis 1: There will be a difference in maximal drumming speed dependent upon warm-up protocols

Conclusion: A 3 x 3 repeated measures factorial ANOVA was calculated to examine the effect of warm-up protocols on maximal drumming speed. No significant within subject main effect of warm-ups was found. The effect of warm-ups ($F(2,24) = 1.346$, $p > .2.79$) on drumming speed was not significant.

Hypothesis 2: There will be a difference in maximal drumming speed dependent upon skill level

Conclusion: A 3 x 3 repeated measures factorial ANOVA was calculated to examine the effect of skill levels on maximal drumming speed. No significant between subject main effect of skill level was found. The skill levels ($F(2,12) = .894$, $p > .434$) on drumming speed was not significant.

Hypotheses 3: There will be an interactive effect between warm-up protocol and skill level upon maximal drumming speed.

Conclusion: A 3 x 3 repeated measures factorial ANOVA was calculated to examine the interactive effect of warm-up protocol and skill level on drumming speed. No significant interactive effect was found. The interaction ($F(4,24) = 1.689$, $p > .185$) was not significant.

DISCUSSION

The general purpose of this study was to examine the different effects of warm-up protocols on various skill levels while performing a single stroke roll. The following section is divided into three subsections: Discussion of Results, Conclusions, and Recommendations.

Discussion of Results

Investigations into whether there was a difference in drumming speed of various skill levels dependent upon warm-up protocols showed no significant difference in performance. A 3 x 3 repeated measures ANOVA was calculated to examine the effects of warm-up protocols and skill levels on maximal drumming speed. The warm-up protocol and skill level interaction ($F(4,24) = 1.689$, $p > .185$), warm-up protocol ($F(2,24) = 1.346$, $p > .279$), and skill levels ($F(2,12) = .894$, $p > .434$) were not significant.

Table 1. Results of 3 x 3 Repeated Measures ANOVA

Source	F	Significance (p > .05)
Warm-up Protocols	3.012	.108
Skill Levels	.690	.521
Interactive Effect	.894	.434

Table 2 shows the mean strikes per minute for each skill level and warm-up protocol. The beginner skill level had a mean between 585.33-596.33 strikes per minute depending upon the warm-up protocol, while the intermediate skill level had a mean between 667.50-701.50 strikes per minute depending upon the warm-up protocol and finally the advanced skill level had a mean between 716.00-725.75 strikes per minute depending upon warm-up protocol. This is consistent with what the researcher hypothesized stating that there will be a difference in maximal drumming speed dependent upon skill level. One thing that needs to be considered is the standard deviation. Due to the large standard deviation, anywhere from 46.446-118.024, there is an overlapping effect between skill levels. A possible conclusion that can be drawn is that while the majority of

the subjects fell into the appropriate skill category, a few subjects caused an overlap of the skill level means. This shows that the skill levels did not always coincide with the years of experience playing drums. Therefore it may be beneficial to examine a better way to classify skill levels than years of playing experience.

Table 2. Mean Drumming Scores

Skill	**Heat (SD)**	**Stretching (SD)**	**Rudiments (SD)**
Beginner	593.6 (80.21)	585.3 (69.42)	596.3 (92.87)
Intermediate	667.5 (111.88)	701.5 (108.50)	689.2 (118.02)
Advanced	717.0 (46.44)	716.0 (50.00)	725.7 (49.56)

It was hypothesized that there would be a difference in maximal drumming speed dependent upon warm-up protocols. As the mean drumming scores for heat was examined, a mean range of 593.6-717.0 with a standard deviation between 46.44-111.88 dependent upon which skill level they were classified as. When statistically analyzing the heat score and performance, it was discovered that there was no significance. When stretching was analyzed, the mean was between 585.3-716.0 with a standard deviation between

50.00-108.50. This too was shown not to have significant difference. Finally, rudiments were examined. The rudimental mean was between 596.3-725.7 with a standard deviation between 49.56-92.87. Once again, no significance was found.

The researcher hypothesized that there would be an interactive effect on differing groups dependent upon the warm-up protocols. It was thought that all skill levels would be effected by heat due to the physiological changes that are caused by heat on the body, such as a decreased resistance of muscles and joints and an increase in release of oxygen.[2] It was also thought that the beginner skill level would be most affected by stretching due to the tendency of beginning drummers to tense up while performing on the Drumometer Model II. While all skill levels can tense up while playing, intermediate and advanced players have the ability to stay more relaxed than beginners. Lastly, it was thought that the advanced skill level would perform better when rudiments where performed because of the coordination that the rudiments provide. Advanced players performed the rudiments more proficiently than the beginners or intermediate skill levels, so it was thought that they would benefit the most by possibly striking the Drumometer Model II in a more efficient manner. However,

after performing the research and statistical analysis, it was discovered that no significant interactive difference was found between skill levels and warm-up protocols.

The results are surprising due to the literature that on performance and warm-ups. Research has shown that an active warm-up can possibly improve both long-term and intermediate performance (longer than 10 seconds and less than 5 minutes if it allows the athlete to begin the subsequent task in a relative non-fatigued state.[2] In this study, testing was only 1 minute long so it falls under this category, it also lets the subjects begin in a non-fatigued state. Studies have also shown that the majority of effects of warm-ups have been attributed to temperature-related mechanisms, such as decreased stiffness, increased nerve-conduction rate and an increased anaerobic energy provisions, which was attempted during this study.[4]

The results also showed a possible learning effect. Each day of testing, the subject was given three chances to strike the Drumometer Model II with as many single strokes as possible. The majority of subjects struck the Drumometer Model II with the most strikes on their third attempt and had the fewest amount of strikes on their first attempt. Table 3 shows this possible learning effect where H1 (heat first attempt) is generally less than H3 (heat

third attempt). This table does not take into account the scores that were disqualified due to double strokes.

Table 3. Strikes Per Minute After Warm-up Protocols

Subject	H1	H2	H3	R1	R2	R3	S1	S2	S3
1	703	725	738	686	692	695	696	711	716
2	775	772	783	787	784	790	760	801	808
3	658	669	671	647	650	662	683	682	690
4	804	821	816	805	816	835	815	835	843
5	527	554	579	522	533	551	548	584	602
6	701	708	714	716	726	731	665	674	694
7	479	508	517	413	483	499	462	510	506
8	682	678	690	683	699	710	674	676	699
9	624	642	651	655	669	677	633	647	658
10	628	646	667	641	667	684	524	635	646
11	754	766	761	756	766	797	714	762	770
12	585	661	635	610	633	659	610	633	664
13	718	731	728	728	738	744	702	716	732
14	660	724	741	660	712	712	650	728	725
15	554	570	606	549	591	606	583	615	584

There are also various measures of performance such as speed, timing, accuracy, endurance and coordination that may be effected by these warm-up protocols. Rudiments are designed specifically to increase hand coordination and this coordination may help improve the accuracy of the strikes on the Drumometer Model II. The physiological effects of heat may play a vital role in increasing muscle endurance while striking the Drumometer Model II. Stretching may also play a role timing and coordination by increasing range of motion.

Conclusions

The findings of this study show that neither heat, rudiments or stretching had a significant effect on maximal drumming speed on drummers of various skill levels. However, the trends seen in the results showed that further investigation is needed on this topic. This may include testing the effects of warm-ups on factors other than speed, such as timing, accuracy, endurance, and coordination. Nevertheless, research still supports the use of warm-ups to increase performance. It was shown that active warm-ups can possibly result in slightly larger improvements in short-term performance (less than 10 seconds) compared to passive heating alone. However, short-term performance may be impaired if the warm-up is too intense or does not allow sufficient recovery and results in a decreased availability of high energy phosphates before starting the task.[3] Active warm-ups have also shown to improve both long-term and intermediate performance (greater than 10 seconds and less than 5 minutes) if it allows the athlete to begin the subsequent task in a relative non-fatigued state, but with an elevated VO_2. While passive warm-ups have shown to improve immediate

performance, both passive and active warm-ups may have detrimental effects on endurance performance. By manipulating intensity, duration and recovery, many different warm-up protocols may be able to achieve similar physiological and performance changes.

Recommendations

The findings of this study show that using neither heat, rudiments or stretching as a warm-up had a statistically significant effect on maximal drumming speed. As for future research, it is suggested to work to minimize the learning effect. This can be done by having subjects come in for a drum lesson on the Drumometer Model II before they start their baseline testing. This would help them get acquainted with the equipment and used to playing the single stroke roll and the 13 essential rudiments.

It is also recommended to find a more sufficient way to divide up the groups into skill levels. In this study people playing up to 4 years were considered beginners. People playing 5-9 years were considered intermediate players, and finally, people who have been playing for 10+ years were considered advanced. This did not necessarily

reflect the results that were received as shown by the overlap in numbers.

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APPENDICES

APPENDIX A

Review of Literature

REVIEW OF THE LITERATURE

Introduction

During the past decade, previously unmet medical needs of performing arts have fostered the rise of a new medical subspecialty: performing arts medicine.[1] The increasing number of reported performance-related injuries plays a part in this as well as the musicians willingness to seek medical attention. As with athletes, the demands and stress on the performing musician is very high. The combination of speed, coordination, accuracy, consistency and timing create a situation in which injuries are prevalent. Many variables must be considered when analyzing the potential for injury in artistic performance.

The variables in performing arts medicine can be broken down into two categories. The first being the capabilities and limits of each instrument and the musician themselves.[1] The capabilities and limits of each instrument are relative constants, and for this reason, generally predictable. The musician, on the other hand, is very unpredictable, because each artist has his or her own strengths and weaknesses. A common misconception is that playing an instrument is a natural action.[2] From a

physiological standpoint, playing an instrument is not a natural or automatic behavior for the body. Due to these variables, injuries can occur and the need for a medical professional may be necessary.

While musicians are becoming more willing to seek medical attention, there are several factors that keep musicians from seeking medical care.[1] The first is the absence of highly visible signs of injury. Most injuries of musicians are not as overt as typical athletic injuries, therefore, musicians do not seek care as readily as athletes.[1] Second is the fact that musicians are often told that discomfort is inevitable. Third, musicians also often feel that the injury is their fault due to the stresses they are putting on their body. Fourth, musicians fear the risk of loss of employment due to inability to play. Lastly, musicians can be reluctant because of the belief that treatment will change their technique on their instrument. While these factors are understandable, they can be associated with a lack of information or misinformation about performing arts medicine. Seeking help from a sports medicine specialist may help prevent injuries and decrease the amount of time the musician loses because of an injury. This is especially true for

musicians, such as percussionists, because their whole body is involved in playing their instrument.

Being a percussionist is a very physically demanding activity. Percussionists will spend countless hours working on increasing speed, endurance, power, timing, consistency and accuracy. Beyond just playing, one must take into account the factor of travelling, the number of shows and rehearsals being performed, the weight of the gear being transported, little sleep and poor nutrition. Even with great technique, these demands can lead to fatigue and injury.

Biomechanics

Drumstick grip is the first technique that should be discussed. There are three main types of grips: the match grip, traditional grip, and the French grip. This study will be done using the match grip due to its high prevalence among drummers. While using match grip, both hands mirror each other. The key to remember is that the drummer must remember to stay relaxed as tension and drumming do not mix at all. Shoulders and upper arms should always be in a natural position. The elbow should

be very relaxed, but not laying against the body. Once the hands are loose, speed and power will follow.

The first step in the match grip is to leave an inch and a half of the stick out of the back of the hand. Next, re-set the “fulcrum point.” The point between the thumb and first finger is known as the “fulcrum” or balancing point. Now, picture a line splitting the stick in half horizontally. The thumb can sit on top of the imaginary line or in the middle of it. The three back fingers lay relaxed wrapped around the stick. There is a tendency to leave the pinky and ring finger off the stick when they play. If this happens; it can hinder future advanced control capabilities. Once this is done, the wrist must be discussed. Some teachers like it parallel to the ground, some like the thumb straight up, and some like it in between. The final step is to setup the left hand exactly like the right hand.

Before the drum is struck, the drumsticks should form the letter “V” above the drumhead. The tips of the sticks should be about an inch apart. Hold the drumsticks 3 inches above the drumhead. Starting with your right hand, move your wrist (not your arm) to raise the stick 6-8 inches above the drumhead (this is known as the up position). Strike the drumhead lightly just forward of the

center with a quick down-up motion and let the wrist return the stick to the up position. Repeat with the left hand, and make sure that you strike each stick with equal force.

Knowledge of anatomy and biomechanics of the hand are important to have a successful hand examination and assessment.[3] A study was performed to examine the truth of this. The only restriction to be a subject in this study was that you had to experience trauma to the hand. All ages and races were included in this study. The independent variable was the special tests used during the hand examination while the dependent variable was the injuries that were missed due to bad examinations. The results showed that the better the examinations are, the fewer amounts of injuries you miss. It is imperative to have a great understanding of anatomy to perform a successful hand examination. To better understand this, the human rate limit for voluntary rhythmic movement must be examined.

As the human rate limit for voluntary rhythmic movement was examined, it was assumed that the movement was between 5-7Hz, but there has been recent report that a drummer won a contest by moving his wrists at a rate of 10Hz.[4] The subjects of this study included drummers, non-drummers and the world’s fastest drummer. The independent

variable was the skill of the drummer and the dependent variable was the taps per minute that the drummers performed. The results showed that a greater skill level can produce a movement greater than 7Hz. To accomplish this one must keep the wrist compliant and not stiff. The question here is whether or not a warm-up routine can help increase your speed.

Warm-up Routines and Performance

While there is a scarcity of well controlled studies with large subject numbers and appropriate statistical analysis, a number of conclusions can be drawn regarding the effects of warm-ups on drumming performance.[5] First there are two types of warm-ups, active and passive. Active warm-ups involve exercise and are likely to induce greater metabolic and cardiovascular changes than passive warm-ups. Passive warm-ups involve raising the muscle temperature or core temperature by some external means (hot pack, hot shower, etc.). The first conclusion that can be drawn is that active warm-ups tend to result in slightly larger improvements in short-term performance (less than 10 seconds) compared to passive heating alone.[5] However, short-term performance may be impaired if the warm-up is too

intense or does not allow sufficient recovery and results in a decreased availability of high energy phosphates before starting the task. Active warm-ups have also shown to improve both long-term and intermediate performance (greater than 10 seconds and less than 5 minutes) if it allows the athlete to begin the subsequent task in a relative non-fatigued state, but with an elevated VO_2.[6] While passive warm-ups have shown to improve immediate performance, both passive and active warm-ups may have detrimental effects on endurance performance. By manipulating intensity, duration and recovery, many different warm-up protocols may be able to achieve similar physiological and performance changes.

A study performed by Bishop showed that a majority of the effects of a warm-up are due to a temperature-related mechanism. The subjects were both male and female and trained and untrained individuals. The independent variable was a warm-up. The dependent variable was the measured results of the performance. The results showed that the warm-up effects can be due to a temperature-related mechanism. While it has been hypothesized that warm-ups may have a number of effects, the majority of the effects of warm-up have been attributed to temperature-related mechanisms as shown in Table 4 and 5.[6]

Table 6. Temperature Related Effects of Warm-ups

Temperature Related Effects
Decreased resistance to muscles and joint
Greater release of oxygen from hemoglobin and myoglobin
Speeding of metabolic reactions
Increased nerve conduction rate
Increased thermoregulatory strain

Table 7. Non-Temperature Related Effects of Warm-ups

Increased blood flow to muscles
Elevation of baseline oxygen consumption
Postactivation potentiation
Psychological effects and increased preparedness

However, other mechanisms have also been proposed (e.g. effects of acidemia, mobilization of the aerobic system and increased postactivation potentiation). Despite the above mentioned mechanisms, it appears that passive warm-up does not improve isometric force, but may improve short-duration (<10 seconds) dynamic force. There are improvements in dynamic short-term performance (e.g. vertical jumping and sprint cycling) that tend to be less than those reported for isolated muscles. While the mechanisms remain to be fully elucidated, it also appears that passive warm-up can improve intermediate performance (~10 seconds to 5 minutes).[6] Passive warm-up does not

improve, and may have a detrimental effect on, long-term performance (>5 minutes), possibly via an increase in thermoregulatory strain. There are several protocols that may help improve warm-ups, and ultimately, performance.

Warm-up Protocols

Heat

The first study of the effects of hot and cold pack treatments on the motor performance of the upper extremity showed that hot and cold pack treatments had an effect on the motor performance of the hand indicated by reaction time, speed of movement and tapping speed. Both hot and cold pack treatments delayed simple reaction time. With cold packs this was an expected reaction because of decreasing performance of the extension muscles of the forearm. However, with hot pack treatment the same phenomenon was a surprise, because warming can decreases joint stiffness and increases blood flow and collagen extensibility.

Based on the results of the research, hot and cold treatment of the upper extremity have effects on the performance of the hand expressed as reaction time, speed of movement and tapping speed.[7] Although hot and cold packs

affect motor performance, cold packs negatively affect speed of movement and tapping speed while hot packs significantly improved taking speed. Moreover, hot packs increased tapping speed immediately and 30 minutes later. These changes were emphasized on fine motor movements of the finger performed with fast back-and-forth movement of antagonistic muscles. On the other hand, reduction in fine hand function may be insignificant when dealing with gross musculoskeletal function and the need to reduce pain, which stretching may help with.

Stretching

It is a common practice to use pre-exercise stretching to enhance performance and prevent injuries by increasing flexibility. However, a recent review article does not support this notion.[9] Research was done where the different types of stretching performed before performance were looked at and their results on performance. The results state there is limited scientific data to support the suggested benefits of stretching. Despite stretching commonly being performed before exercise to enhance performance and reduce the risk of injury, there is limited scientific data to support the suggested benefits of stretching.

Static and ballistic stretching have been shown to have detrimental effects on muscle strength and functional performances such as jumping, and to have inconclusive effects on the incidence of injury, and no effects on the severity of muscle damage. Even though research has indicated that stretching is an effective treatment to increase static flexibility (range of motion), the effects on dynamic flexibility (muscle stiffness) are inconclusive given the variation of the length of hold and the number of repetitions used in studies.

In the world of sports, stretching has recently undergone a transformation from a generally assumed aspect of training to a more scrutinized contributor that may or may not be supported by the outcome of enhanced sport performance.[9] The aim of stretching is to increase flexibility, but the question of whether flexibility helps to enhance performance has not been answered. The ideal flexibility for the performance of each sports activity is different. Compliant muscle fibers might be beneficial to eccentric contraction while stiffer muscle fibers might be more suitable for concentric and isometric contractions.[10] Does flexibility help to reduce the rate of injury? The majority of research does not support this statement. Stretching can also affect strength performance.

Many activities rely heavily on strength, but strength performance may be diminished by a preceding stretching routine; therefore, it is important to understand the phenomenon when prescribing physical exercise programs.[11] There appears to be substantial evidence suggesting a decrease in strength following stretching. Studies used different stretching techniques, duration and targeted different muscle groups, and were tested with isotonic, isometric and isokinetic devices. However, the number of exercises, duration of each exercise and number of sets was much longer than the ranges normally used in practice. Another protocol that may increase speed is the use of rudiments.

Rudiments

Often called the 'building blocks of drumming' and equated with the scales played on melodic instruments, drum rudiments consist of short rhythmic phrases with specific stickings.[12]

The first set of standardized drum rudiments was created by the National Association of Rudimental Drummers (NARD) in 1933 and consisted of 26 rudiments that were considered essential by its members. The Percussive Arts Society (PAS) expanded this set in 1984 by compiling a list

of 40 International Drum Rudiments, which included the original 26 NARD rudiments, along with drum corps, European, orchestral and contemporary snare drum rudiments that had become popular. Many drum set players use rudiments for technique development and adapt rudiments to other styles of music. Jazz drummers such as Buddy Rich and Joe Morello often displayed a rudimental influence; rock drummer Spencer Dryden played a rudimental-style snare drum introduction on Jefferson Airplane's 1960s hit 'White Rabbit'; and Steve Gadd's drum part on Paul Simon's 1970s hit '50 Ways to Leave Your Lover' was rudimentally based.[12]

Injuries

Warm-up and prevention

Muscular injury is one of the major problems facing today's athletes and musicians, both recreational and professional. Injuries to skeletal muscle represent greater than 30% of the injuries seen in sports medicine clinics.[13] As a result, it is imperative to utilize the most effective means to aid in deterring these injuries. However, there are conflicting opinions regarding methods of reducing muscular injury through warm-up and stretching techniques.

There are conflicting views in regards to what is the best way to reduce injury.[14] This study was done to see if a warm-up or stretching can prevent or reduce muscular injury. Subjects studied included both male and female and trained and untrained individuals. The results showed contradictory evidence to the question above. In the end, there is not enough evidence to answer whether or not a warm-up/stretching can prevent muscular injury. If a drummer chooses to use a warm-up, it should be implemented prior to physical activity. Ideally, it should occur about 15 minutes prior to the activity and be tailored to the individual as well as the activity. This includes the elbow, forearm and wrist. It should produce a mild sweat, but avoiding fatigue.

Elbow forearm and wrist

Competitive and recreational athletes sustain a wide variety of soft tissue, bone, ligament, tendon and nerve damage to their upper extremities.[15] Most such injuries are related to direct trauma or repetitive stress, and account for a significant amount of ‘down time’ for athletes participating in a wide range of sports, particularly those in which the arm is utilized for throwing, catching or swinging. Overuse injuries to the elbow include

musculotendinous injuries, ulnar nerve injuries and ligamentous injuries.[15] Osteochondrol lesions of the capitullum and posterior impingement injuries in the joint are frequently seen in athletes as well. Acute traumatic injuries to the elbow include tendon ruptures, elbow dislocations and intra-articular fractures. Forearm overuse injuries in athletes include fracture of the carpal scaphoid, fracture of the hook of the hamate, Kienbock's syndrome and pisoquetral syndromes. Ligamentous injuries include scapholunate, lunotriquetral and midcarpal instability injuries. Injuries to the distal radio-ulnar joint and triangular fibrocartilage are also quite common in athletes, and require careful evaluation and treatment.

Epicondylar injuries are another common elbow injury that has been studied.[16] The subjects studied were athletes mostly from golf, tennis and baseball. The independent variable was the treatment received (NSAIDs, corticosteroids, massage, laser therapy, acupuncture, strengthening, shockwave therapy and mobilizations). The results showed controversy as to what was the best treatment, and further research needs to be done to demonstrate the best treatment for epicondylar injuries. Further distally, hand and wrist injuries need to be discussed.

Evaluating hand and wrist injuries depends on knowledge of basic anatomy and biomechanics of the hand and wrist.[17] The wrist is composed of two rows of carpal bones. Flexor and extensor tendons cross the wrist to allow function of the hand and digits. The ulnar, median, and radial nerves provide innervation of the hand and wrist. A systematic primary and secondary examination of the hand and wrist includes assessment of active and passive range of motion of the wrist and digits, and dynamic stability testing. The most commonly fractured bone of the wrist is the scaphoid, and the most common ligamentous instability involves the scaphoid and lunate. An example of a common wrist injury would be carpal tunnel syndrome.

Carpal Tunnel Syndrome

It is very important to assess the value of a history and physical exam findings in diagnosing carpal tunnel syndrome.[18] Subjects studied included males and females with wrist pain and/or neurological symptoms. The independent variable was the diagnostic tests that were used in the study. The dependent variable was how accurate each test was. The results showed that a Tinnel's sign with a positive hand pain diagram was the best predictors of carpal tunnel syndrome. It was also found that Phalen's

was the worst predictor of carpal tunnel syndrome and age may play an issue in carpal tunnel syndrome.

Carpal tunnel syndrome has an increased rate among people whose occupation involves repeated flexion and extension.[19] A study was done to see how prevalent carpal tunnel syndrome (CTS) is in the presence of wrist flexion and absence of repetitive movements. The subjects were males and females who did not have a history of CTS. The independent variable is the tests that were used to help diagnose CTS. The dependent variable is how effective each test was on diagnosing CTS. The results showed that the positioning of the wrist in flexion, in the absence of repetitive movement in the hand, can cause CTS. This is presumably due to an increase in intracarpal pressure during prolonged position of flexion of the wrist or due to compression by the proximal edge of transverse carpal ligament.

Performance

Athletics

The wrist joint and how humans control their wrists have been studied extensively. In this study humans and baboons were studied. Knowledge of the periphery, from

biomechanics, muscle properties and motor unit recruitment, is quite sufficient to allow us to understand movement of the forearm. Knowledge of the central control, including the spinal cord circuitry and the supraspinal centers, is, by contrast far from adequate. Some peripheral diseases, such as occupational dystonia, have frequently been suggested to arise from excessive use of forearm muscles and joints. This also relates to the art of drumming.

Drumming

To understand how high levels of skill are developed and maintained, it is necessary to study elite groups such as professional athletes or musicians.[20] This can lead to the rediscovery of arcane knowledge that has fallen into neglect through a lack of appreciation of its significance. A study was done in which subjects included were musicians and non-musicians. The independent variable is the musician playing at a high level. The dependent variable is the cortical activation. The results showed that being a very skilled musician can structurally change your motor areas of the brain. In the end, the combination of functional MRI with its high spatial resolution and magnetoencephalography (which provides excellent temporal resolution) has made investigation of the effects of

training on cortical activity patterns a realistic proposition. As we have seen, by comparing instrumentalists of a professional standard with amateurs and with non-musicians, it has been possible with these techniques to observe the effects of hand training on activity patterns within the regions of the cortex devoted to motor control.

Philosophy, methodology and techniques are required to obtain greater speed on the drums with both hands and feet.[21] Subjects included drummers who wanted to gain greater speed with their hands and feet. The independent variables were proper biomechanical alignment of limbs, proper technique and all equipment properly aligned. The dependent variable was the speed and how much it increased with the independent variables. The results showed that if all the independent variables are used, you can increase your speed with your hands and feet. Being able to develop incredible speed is complicated but can be understood and natural in its practice and application.

The dynamic motor ability of individual fingers was also investigated under four different finger tapping conditions.[22] These were: maximum speed tapping with one finger (single-finger tapping), alternate movement of two fingers (double-finger tapping), double-finger tapping in an unsupported condition, and submaximal constant speed

tapping with one finger in a passive manner. Subjects included 12 healthy male individuals ranging in age from 18-32. The independent variable was when the finger movement was accompanied by an alternate movement of another finger. The dependent variable was the speed of the finger(s). The results showed that when accompanied by an alternate movement of another finger, the fingers were slower than if there was just a single finger movement. In conclusion, it was found that the index finger attained the fastest cadence and greatest movement velocity, followed by the middle, little and ring fingers, respectively.

Speed

A study was done to investigate tapping speed asymmetry in 13 right-handed drummers and 13 right-handed non-drummers.[23] The subjects included 13 right-handed drummers and 12 right-handed non-drummers. The independent variable was the level of the drummers (experience versus no experience). The dependent variable was the speed. The results showed no difference in the drummers versus non drummers in the right hand, but showed a significant difference in speed in the left hand (drummers had a higher speed). In conclusion, these results suggest that the tapping speed of the non-preferred hand progressed nearly

to the level of the preferred hand through daily drum training.

Conclusion

During the past decade, previously unmet medical needs of performing artists have fostered the rise of a new medical subspecialty: performing arts medicine.[1] The increasing number of reported performance-related injuries plays a part in this as well as the musicians willingness to seek medical attention. As with sports athletes, the physical demands and stresses on the performing musician are very high. The combination of speed, coordination, accuracy, consistency and timing create a situation in which injuries are prevalent.

There are conflicting views in regards to what is the best way to reduce injury and increase performance.[14] In the end, there is insufficient evidence to answer whether or not a warm-up or stretching can prevent muscular injury, but there is some research that shows the potential for a relationship between warm-up and performance. If one chooses to use a warm-up, it should be implemented prior to physical activity. Ideally, it should occur about 15

minutes prior to the activity and be tailored to the individual as well as the activity.

APPENDIX B

The Problem

THE PROBLEM

Statement of the Problem

Seeking help from a sports medicine specialist may help prevent injuries and decrease the amount of time the musician loses because of an injury. This is especially true for musicians, such as percussionists, because their whole body is involved in playing their instrument. One of the issues that presents itself is the lack of information on warm-ups and their effects on performance and injury prevention. If this is combined with the contradictory evidence found in studies, a problem presents itself.

The purpose of the study is to examine the difference in maximal drumming speed of various skill levels dependent upon warm-up protocols. It is important to examine this relationship so athletic trainers working in the performing arts can decide what warm-up can possibly increase speed on a single stroke roll. Additionally, it would be beneficial for drummers to know which types of warm-up can increases their speed.

Definition of Terms

The following definitions of terms will be defined for this study:

1) Rudiment – a basic drum patterns which are the basic building blocks of drumming.
2) Single Stroke Roll - the most basic rudiment which alternates R and L hits.
3) Sticking – a series of R’s and L’s combined to make a pattern where R stands for Right and L stands for Left.

Basic Assumptions

The following are basic assumptions of this study:

1) The subjects will be honest when they complete their demographic sheets.
2) The subjects will perform to the best of their ability during testing sessions.
3) The Drumometer Model II will be calibrated correctly.

Limitations of the Study

The following are possible limitations of the study:

1) The validity of the single stroke roll test has not been established as a measure of drumming competence.

2) Subjects can be inconsistent in their effort during testing.

Significance of the Study

Since the rise of performing arts medicine, musicians are becoming more willing to seek medical attention. With the lack of studies on the subject of warm-ups on the single stroke roll and the contradictory results, this study is designed to help bring clarity as to whether or not a warm-up, and which warm-up, will increase the speed of a single stroke roll. Since single stroke rolls are one of the basic building blocks of drumming, this is an important concept.

The results of this study will mean that percussionists will know whether heating, stretching or rudiments can possibly be used as a warm-up to increase their speed on a single stroke roll. It will also show how much each warm-up protocol increased their speed. The question of what warm-up protocol will have a positive

effect on various skill levels is important so percussionists can have a time efficient and beneficial warm-up. What this means is that the same warm-up protocol may not have the same benefits between different skill levels. This study is designed to show what warm-up protocol, if any, is beneficial at each skill level and by how much speed is increased. If a subject at a certain skill level has been using an ineffective warm-up, the goal of this study is to present them with an idea of how they can increase their speed by changing their warm-up protocol.

APPENDIX C

Additional Methods

APPENDIX C1

Informed Consent Form

California University of Pennsylvania

Informed Consent Form

1. Micah Holland, who is a Graduate Athletic Training Student at California University of Pennsylvania, has requested my participation in a research study at California University of Pennsylvania. The title of the research is, “The difference in drumming speed of various skill levels dependent upon warm-up protocols.”

2. I have been informed that the purpose of this study is to discover the difference in drumming speed of various drummer skill levels following 3 different warm-up protocols. I understand that I must be 18 years of age or older to participate. I understand that I have been asked to participate along with other drummers because I have had no shoulder, arm, elbow, forearm, wrist or hand injuries within the last 6 months nor am I taking any medication that may affect my ability to strike the Drumometer Model II such as Sudafed for a cold or Benadryl for allergies.

3. I have been invited to participate in this research project. My participation is voluntary and I can choose to discontinue my participation at any time without penalty or loss of benefits. My participation will involve performing a single stroke roll test using the Drumometer Model II for 60 seconds after performing a warm-up protocol. I will be tested immediately after the warm-up protocol is finished. My participation in this study will consist of four days of participation starting with an orientation meeting and baseline testing on day one. Day’s 2-4 will consists of different warm-up protocols, which will include heat, stretching and rudiments. Heat will be applied to the top and bottom of forearms, wrists and elbows. It will be applied for 12 minutes before performing the single stroke roll test. Stretching will include the fingers, wrists and forearms and will be done for 30 seconds each. The 13 essentials rudiments will be performed for 30 seconds each with a rest time of 5 seconds in between. Each day will take approximately 30 minutes for a total of 2 hours.

4. I understand there are foreseeable risks or discomforts to me if I agree to participate in the study. With participation in a research program such as this there is

always the potential for unforeseeable risks as well. The possible risks and/or discomforts include possible soreness from stretching, and discomfort from a hot pack. The researcher will stand by closely during the warm-up and testing in case I need help.

5. I understand that, in case of injury, I can expect to receive treatment or care in Hamer Hall's Athletic Training Facility. This treatment will be provided by the researcher, Micah Holland, under the supervision of the CalU athletic training faculty, all of which can administer emergency care. Additional services needed for prolonged care will be referred to the attending staff at the Downey Garofola Health Services located on campus.

6. There are no feasible alternative procedures available for this study.

7. I understand that the possible benefits of my participation in the research is to help discover the difference in drumming speed of various skill levels dependent upon warm-up protocols. This study can help athletic trainers in the performing arts decide what is the best warm-up to increase speed of the single stroke roll.

8. I understand that the results of the research study may be published but my name or identity will not be revealed. Only aggregate data will be reported. In order to maintain confidentially of my records, Micah Holland will maintain all documents in a secure location on campus and password protect all electronic files so that only the student researcher and research advisor can access the data. Each subject will be given a specific subject number to represent his or her name so as to protect the anonymity of each subject.

9. I have been informed that I will not be compensated for my participation.

10. I have been informed that any questions I have concerning the research study or my participation in it, before or after my consent, will be answered by:

MICAH HOLLAND, ATC, PES
STUDENT/PRIMARY RESEARCHER
HOL3820@CalU.EDU
815-222-1339

THOMAS F. WEST, PhD, ATC
RESEARCH ADVISOR
WEST_T@CalU.EDU
724-938-5933

11. I understand that written responses may be used in quotations for publication but my identity will remain anonymous.

12. I have read the above information and am electing to participate in this study. The nature, demands, risks, and benefits of the project have been explained to me. I knowingly assume the risks involved, and understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. In signing this consent form, I am not waiving any legal claims, rights, or remedies. A copy of this consent form will be given to me upon request.

13. This study has been approved by the California University of Pennsylvania Institutional Review Board.

14. The IRB approval dates for this project are from: 01/28/2010 to 01/28/2010.

Subject's signature:_____

Date:_____

Witness signature:_____

Date:_____

APPENDIX C2

Demographic Information

Demographic Profile Form
"Difference in drumming speed of various skill levels dependent upon warm-up protocols"

Subject ID #: _____ Group Assignment: _____

Subject Name: _____

(last, first)

Academic Year in School: Freshman Sophomore Junior Senior Graduate

Age: _____

Years of playing experience:

_____

Years of studying:

_____

Specialty (Drumline, orchestral, Drum set):_____

Hours of practice a week:

_____

Are you currently receiving treatment for any shoulder, elbow, forearm, wrist or hand injuries?

Yes No

Are you currently taking any medications that may affect your ability to strike the Drumometer Model II such as Sudafed for a cold or Benadryl for allergies:

Yes No

If yes, please explain: _____

_____

Appendix C3

Photo Consent Form

Photo Release Form

Difference in Drumming Speed of Various Skill Levels Dependent Upon Warm-up Protocols
Proposal Number: 09-033
Micah Joseph Holland, ATC, PES

Photo Release

I request the use of (photographic) material as part of my study. I specifically ask your consent to use this material as I deem proper. The material will be used for the research project as I have described in it the informed consent document you have signed. These materials may be used for news releases, professional publications, professional conferences, websites and pictorial exhibits related to my study.

I also emphasize that the appearance of these materials on certain media (websites, professional publications, news releases) may require the transfer of copyright of the images. This means that other individuals may use your image. Regarding the use of your likeness in photographs, please check one of the following:

_____ I **do……**

_____ I **do not……**

Give unconditional permission for the investigator to utilize photographs of me.

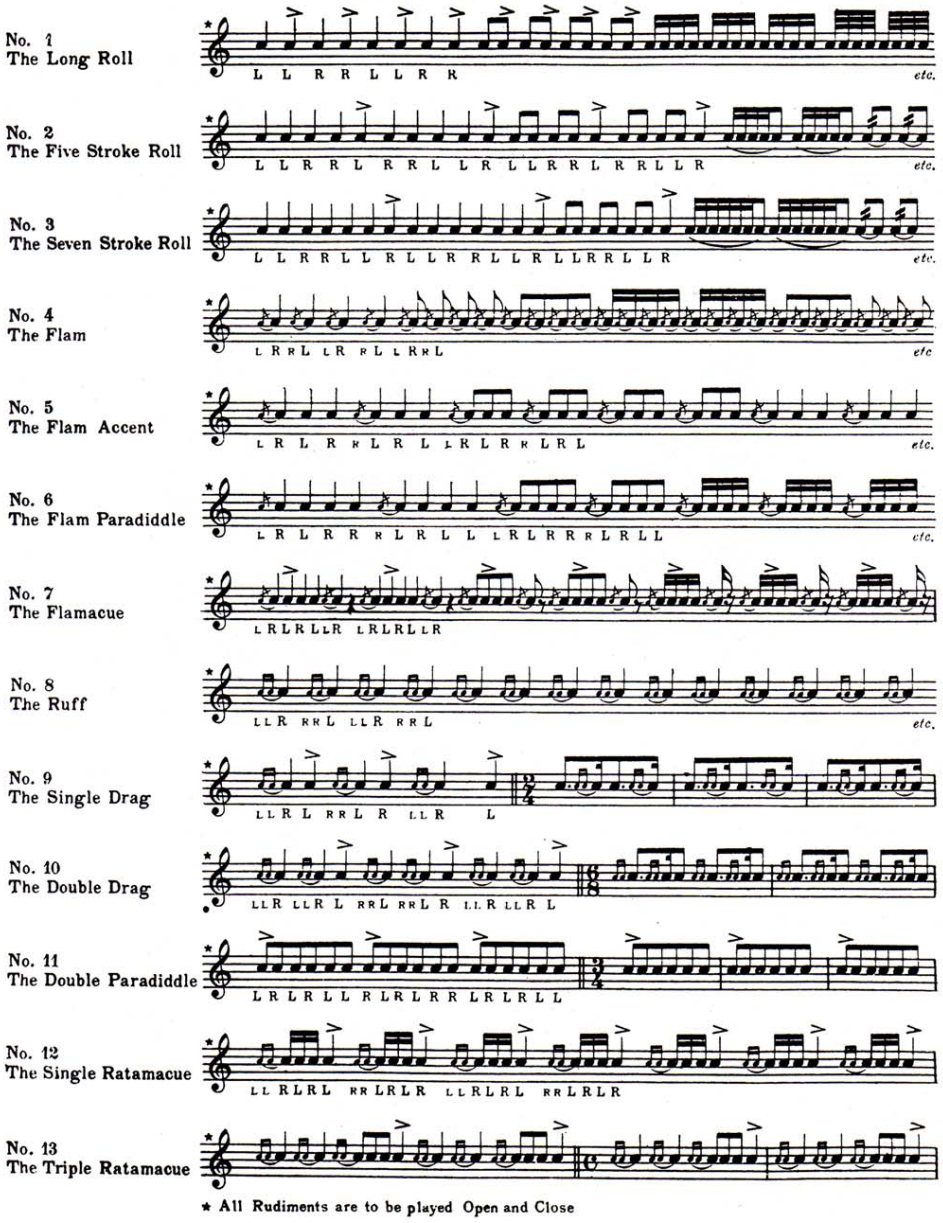
_____ _____
Signature Date

Note: Even should you chose not to allow your image to be used, I can still benefit from your inclusion as a research study participant.

Appendix C3

Warm-up Protocols

Rudiment Warm-up Protocol



Stretching Warm-up Protocol

Stretch 1: Finger flexion stretch

Stretch 2: Wrist flexion stretch

Stretch 3: Wrist extension stretch

Heat Warm-up Protocol

Appendix C5

Data Collection Sheet

Subject	Base	ScoreH	ScoreR	ScoreS	Skill
1	687	738	695	716	3
2	774	783	790	808	3
3	631	671	662	690	3
4	838	821	835	843	2
5	497	554	551	602	2
6	678	714	731	694	3
7	472	508	499	506	1
8	654	682	710	676	3
9	650	651	677	658	3
10	573	667	684	635	1
11	705	766	797	770	3
12	607	635	659	633	2
13	708	731	744	716	3
14	623	660	712	728	2
15	559	606	606	615	1

Appendix C6

Institutional Review Board –

California University of Pennsylvania

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

Dear Micah,

Please consider this email as official notification that your proposal titled "Difference in drumming speed of various skill levels dependent upon warm-up protocols" (Proposal #09-033) has been approved by the California University of Pennsylvania Institutional Review Board as submitted.

The effective date of the approval is 01-28-2010 and the expiration date is 01-28-2011. 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 01-28-2011 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

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 ***Difference in drumming speed of various skill levels dependent upon warm-up protocols***

Researcher/Project Director ***Micah Holland ATC, PES***

Phone # ***815-222-1339*** *E-mail Address* ***hol3820@cup.edu***

Faculty Sponsor (if required) ***Thomas F. West, PhD***

Department ***Health Science***

Project Dates ***January 1, 2010*** *to* ***December 31, 2010***

Sponsoring Agent (if applicable) ***N/A***

Project to be 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 primary purpose of this study is to measure the difference in drumming speed of various skill levels dependent upon warm-up protocols. Healthy subjects from California University of Pennsylvania are expected to participate in this study (N~15). Subjects who have suffered any shoulder, arm, elbow, forearm, wrist and hand withing the last 6 months prior to the test and/or are on medications, such as Sudafed for a cold or Benadryl for allergies, that may hinder their ability to strike a pad with a drumstick will be excluded from this study.

When subjects arrived on the first day they picked a number out of a box to obtain their randomly assigned subject number and group designation. The assigned subject number replaced the subject's name once testing began to maintain subject anonymity. After receiving their subject number, the subjects completed a demographic profile form. Subjects then completed one practice trial using the Drumometer Model II strike counter before they performed their actual test. The practice trial was carried out to allow the subject to familiarize themselves with the Drumometer Model II. After the practice trial was completed, the subject completed the actual tests. The actual test consists of three attempts of the subject hitting the Drumometer Model II as many times as possible in 60 seconds. The highest score was recorded. Subjects were allowed a three minute rest period in-between trials.

After a minimum of one day and a maximum of seven days passed, to minimize a possible learning affect, the subjects returned for day two of testing. When subjects arrived on the second day they were instructed on how to perform the warm-up protocol assigned to them. They then completed their designated warm-up protocol: heat, stretching or rudiments. Once the subjects completed their appointed warm-up, they completed their tests on the Drumometer Model II. Results of the official test were recorded.

After a minimum of one day and a maximum of seven days passed, the subjects returned for day three of testing. When subjects arrived on the second day they were instructed on how to perform the warm-up protocol assigned to them. They then completed their designated warm-up protocol: heat, stretching or rudiments. Once the subjects completed their appointed warm-up, they completed their tests on the Drumometer Model II. Results of the official test were recorded.

After a minimum of one day and a maximum of seven days passed, the subjects returned for day four of testing. When subjects arrived on the second day they were instructed on how to perform the warm-up protocol assigned to them. They then completed their designated warm-up protocol: heat, stretching or rudiments. Once the subjects completed their appointed warm-up, they completed their tests on the Drumometer Model II. Results of the official test were recorded.

A multivariate ANOVA (analysis of variance) will be used to determine the effect of the independent variables (type of warm-up protocol and skill level) on the dependent variable (strikes per minute). This test will examine both the main effects and the interaction. the dependent variable, strikes per minute, was used to calculate a difference in the warm-up protocols. This was calculated by stubtracting the day 1 baseline test from the day 2, day 3 and day 4 test score. An alpha level of P lesser or equal to 0.05 was used to determine statistical significance. SPSS 17.0 was used for this statistical analysis.

The following are the hypotheses that will be examined by this study:
1) There will be a difference in maximial drumming speed dependent upon warm-up protocols.
2) There will be a difference in maximial drumming speed dependent upon skill level.
3) There will be an interaction effect between warm-up protocol and skill level upon maximal drumming speed.

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.*

      The possible risks and/or discomforts are very minimal and include possible soreness from unfamiliar stretches or discomfort from hot packs. To minimize this risk, the researcher will stand by closely during the warm-up and testing incase help is needed. No tests are physically invaisive. If an injury was to occur, foreseable or unforseable, the researcher will take care of the subjects under the supervision of a certified athletic trainer in the Athletic Training Room in Hamer Hall.

   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 subjects will be volunteers from California University of Pennsylvania who are 18 years or older. Prior to the study, subjects will be informed to explain the concepts of this study. Any subject who has injuires to the shoulder, arm, elbow, forearm, wrist and hand within the last 6 months or who are on any medication that will hinder their ability to strike a pad with a drumstick will not be included in this study as these condition may interfere with their testing results. These exclusions will be performed by the supervising Certified Athletic Trainer while maintaining patient confidentiality.

   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 (attached) will be completed and signed by all subjects before participating in this study on the day of the testing. Each signed form will be kept by the researcher.

   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 the spring semester. Subjects will come in 4 times for this study. All collected data which will be identified by subject number will be maintained by the researcher in a secure location in 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?

10

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)

California University of Pennsylvania

Informed Consent Form

1. Micah Holland, who is a Graduate Athletic Training Student at California University of Pennsylvania, has requested my participation in a research study at California University of Pennsylvania. The title of the research is, "The difference in drumming speed of various skill levels dependent upon warm-up protocols."

2. I have been informed that the purpose of this study is to discover the difference in drumming speed of various drummer skill levels following 3 different warm-up protocols. I understand that I must be 18 years of age or older to participate. I understand that I have been asked to participate along with other drummers because I have had no shoulder, arm, elbow, forearm, wrist or hand injuries within the last 6 months nor am I taking any medication that may affect my ability to strike the Drumometer Model II such as Sudafed for a cold or Benadryl for allergies.

3. I have been invited to participate in this research project. My participation is voluntary and I can choose to discontinue my participation at any time without penalty or loss of benefits. My participation will involve performing a single stroke roll test using the Drumometer Model II for 60 seconds after performing a warm-up protocol. I will be tested immediately after the warm-up protocol is finished. My participation in this study will consist of four days of participation starting with an orientation meeting and baseline testing on day one. Day's 2-4 will consists of different warm-up protocols, which will include heat, stretching and rudiments. Heat will be applied to the top and bottom of forearms, wrists and elbows. It will be applied for 12 minutes before performing the single stroke roll test. Stretching will include the fingers, wrists and forearms and will be done for 30 seconds each. The 13 essentials rudiments will be performed for 30 seconds each with a rest time of 5 seconds in between. Each day will take approximately 30 minutes for a total of 2 hours.

4. I understand there are foreseeable risks or discomforts to me if I agree to participate in the study. With participation in a research program such as this there is always the potential for unforeseeable risks as well. The possible risks and/or

discomforts include possible soreness from stretching, and discomfort from a hot pack. The researcher will stand by closely during the warm-up and testing in case I need help.

5. I understand that, in case of injury, I can expect to receive treatment or care in Hamer Hall's Athletic Training Facility. This treatment will be provided by the researcher, Micah Holland, under the supervision of the CalU athletic training faculty, all of which can administer emergency care. Additional services needed for prolonged care will be referred to the attending staff at the Downey Garofola Health Services located on campus.

6. There are no feasible alternative procedures available for this study.

7. I understand that the possible benefits of my participation in the research is to help discover the difference in drumming speed of various skill levels dependent upon warm-up protocols. This study can help athletic trainers in the performing arts decide what is the best warm-up to increase speed of the single stroke roll.

8. I understand that the results of the research study may be published but my name or identity will not be revealed. Only aggregate data will be reported. In order to maintain confidentially of my records, Micah Holland will maintain all documents in a secure location on campus and password protect all electronic files so that only the student researcher and research advisor can access the data. Each subject will be given a specific subject number to represent his or her name so as to protect the anonymity of each subject.

9. I have been informed that I will not be compensated for my participation.

10. I have been informed that any questions I have concerning the research study or my participation in it, before or after my consent, will be answered by:

MICAH HOLLAND, ATC, PES
STUDENT/PRIMARY RESEARCHER
HOL3820@CalU.EDU
815-222-1339

THOMAS F. WEST, PhD, ATC
RESEARCH ADVISOR
WEST_T@CalU.EDU
724-938-5933

11. I understand that written responses may be used in quotations for publication but my identity will remain anonymous.

12. I have read the above information and am electing to participate in this study. The nature, demands, risks, and benefits of the project have been explained to me. I knowingly assume the risks involved, and understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. In signing this consent form, I am not waiving any legal claims, rights, or remedies. A copy of this consent form will be given to me upon request.

13. This study has been approved by the California University of Pennsylvania Institutional Review Board.

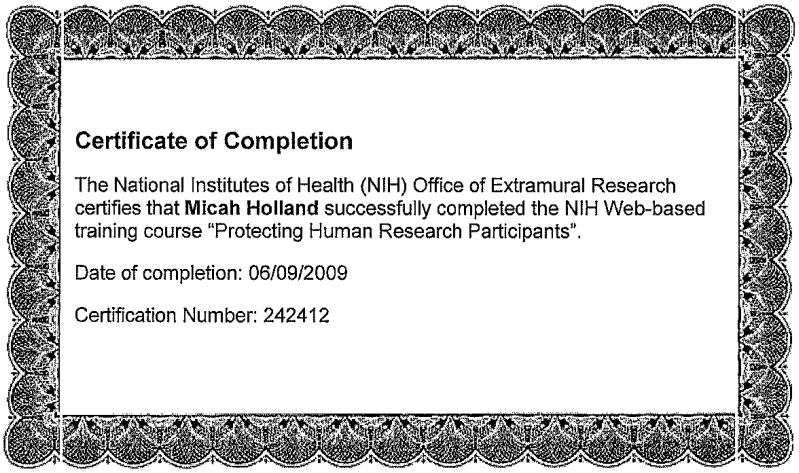
14. The IRB approval dates for this project are from: nn/nn/nnnn to mm/mm/mmmm.

Subject's signature:_____

Date:_____

Witness signature:_____

Date:_____



Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Micah Holland** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 06/09/2009

Certification Number: 242412

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ABSTRACT

Title: Difference in Drumming Speed of Various Skill Levels Dependent Upon Warm-up Protocols

Researcher: Micah Joseph Holland, ATC, PES

Advisor: Thomas F. West, PhD, ATC

Date: May 2010

Research type: Master's Thesis

Context: There is a lack of information on warm-ups and their effects on performance and injury prevention. If this is combined with the contradictory evidence found in studies, a problem presents itself.

Objective: The purpose of this study is to examine the difference in maximal drumming speed of various skill levels dependent upon warm-up protocols.

Design: A within subjects, quasi-experimental design

Setting: Controlled laboratory setting

Participants: 15 volunteering California University of Pennsylvania students who play drums and have no upper extremity injuries or are taking any medications that would affect their ability to strike the Drumometer Model II.

Interventions: Subjects were tested on 4 different days. The first day was a baseline test. The test included hitting the Drumometer Model II as fast as they could for 60 seconds. 3 attempts were given with a 3 minute rest in between. The second day began with a warm-up protocol; heat, stretching or rudiments and then the same testing was completed with the Drumometer Model II. On the third day, another warm-up protocol was performed and then the same drum testing. On the fourth

	day, the last remaining warm-up protocol was performed and then the subject was tested with the Drumometer Model II.
Main Outcome Measures:	Number of strikes on the Drumometer Model II during a 60 second period of time.
Results:	The results showed that there was no significant difference between the warm-up protocols on maximal drumming speed. There was also no significant difference between the warm-up protocols on various skill levels.
Conclusion:	Drummers who are looking only to improve their speed should chose a warm-up of their choice since neither heat, stretching and rudiments was shown to be significant.
Word Count:	297