INTRODUCTION
Current literature on identifying effective ways to fatigue hip muscles implements similar methods using isometric maximal voluntary contractions [1,2]. There is also a large body of research testing hip abductor strength in runners who are already injured, specifically in those with patellofemoral pain syndrome [3,4]. However, it is unknown the degree to which the hip abductors fatigue during a prolonged run. Therefore, the first purpose of this study was to examine the effect of a 30-minute fast run on hip abductor muscle strength.

Furthermore, while research has analyzed changes in lower extremity kinematics over a prolonged run, this literature has solely analyzed kinematics at the onset and conclusion of the run [5]. Knowing how kinematics change over the entire course of the run could lead to a better understanding of the role of fatigue on injury. Therefore, the secondary purpose of this study was to analyze changes in running kinematics at multiple time points throughout the fatiguing 30-minute run.

METHODS
To be included, subjects needed to be between 18-45 years old, average over 20 miles per week, and have no major injuries over the past 6 months. To date, this study has analyzed 2 of 8 runners included. The subjects first completed a brief, five-minute warm up run on a treadmill. Hip abduction strength was tested using a Biodex System 3 Dynamometer (Biodex Medical Systems) prior to the run. For this measurement, subjects lay in a hip-sidelying position at neutral hip rotation while pushing into the dynamometer arm in the direction of abduction. This isometric contraction was completed three times pre- and post-run. Hip strength was calculated by dividing the average peak torque of the 3 pushes and normalized by bodyweight for analysis.

Thirty-nine reflective markers were then placed on the subject’s body. To calculate the appropriate treadmill pace to induce fatigue, each subject reported their current 5,000m race pace. This time was used to estimate their 30-minute threshold pace, which was maintained for the duration of the treadmill run. At five-minute intervals throughout the run, kinematic data was recorded using our 10-camera motion capture system (Motion Analysis Corp.) sampling at 200 Hz.

RESULTS AND DISCUSSION
To date, no statistics have been run on the data. For subject 1, pre-fatigue strength testing yielded a normalized average peak torque of 1.83 Nm/kg, while post-fatigue normalized hip abductor strength was measured at 1.66 Nm/kg. This indicates a 9.7% drop in hip abductor strength as a result of the fatigue protocol. Subject 2 yielded a normalized pre-fatigue measure of 1.80 Nm/kg, while post-fatigue normalized strength was 1.59 Nm/kg. Thus, subject 2 saw an 11.7% drop in hip abductor strength as a result of the fatigue protocol. Altogether, these results indicate an average 10.7% drop in hip abductor strength.

Kinematic data measured throughout the run showed that our subjects had a higher degree of knee valgus towards the end of the run; initial-peak valgus average was 4.94°, final-peak valgus average was 6.21°. We found similar changes in peak hip internal rotation (IR), as the initial-peak IR angle was 15.3° and final-peak was 17.2°. Measurements of pelvic drop showed initial measurements at 5.4° and a final-recording of 5.9°. We also examined peak hip adduction angle, which showed an initial average of 12.6° and final average of 12.8°.

Preliminary results show decreases in hip abductor strength after the fatiguing run, which could indicate that this new protocol effectively fatigues hip abductor muscles. However, this amount of fatigue is significantly less that localized hip abductor fatigue protocols [1,2].

A potential trend was seen with increased peak knee valgus and hip internal rotation throughout the duration of the run. These markers are both indicators of potential injury in runners [3,4], meaning that running-induced fatigue could increase one’s risk of injury. We have yet to see large changes in other indicators of injury, such as peak hip adduction and pelvic drop.

CONCLUSIONS
A 30-minute fatiguing run resulted in a decrease in hip abductor strength and increased peak knee valgus and hip internal rotation in both runners analyzed. More subjects will be needed to be analyzed to confirm these trends statistically.

REFERENCES

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