**Paper Notes**

*Prediction of Future Injury in Sport: Primary and Secondary Anterior Cruciate Ligament Injury Risk and Return to Sport as a Model*

* **Contamination:** if a study of athletes is contaminated by prior interventions relating to a modifiable outcome variable that’s used as a risk indicator, a large percentage of subjects may have been unknowingly exposed to outcome-altering interventions.
  + The timing, volume, and duration of interventions before and after screening must be accounted for, quantified, and included in any valid prediction model
* **Surveillance:** a flawed injury surveillance system and the extended and varying time between screening and injury
* **The Flaw of Normalization:** normalizing should be avoided in the development of predictive injury models. This team found in their previous study that non normalized knee abduction was highly predictive of injury risk, but normalized knee abduction was not able to predict ACL injury in mixed-effects logistic regression models.
  + Basically, non-normalized data had more predictive capabilities
  + Reasoning: normalized events and moments aren’t naturally occurring, therefore they cannot be soundly used for prediction
* **Injury Prediction and the Second Injury Dilemma**
  + Obviously, the best predictor for a second injury is a prior injury
* Overall, they don’t have any real results to share. They believe themselves experts on injury prediction and give guidelines on what future projects should do. Honestly, they seem rather pompous in their writing, but that’s just me.

*Repeated Exposure to Established High Risk Workload Scenarios Improves Non-Contact Injury Prediction in Elite Australian Footballers*

* Objective: assess the effect of multiple high-risk scenario exposures on injury prediction
* Methods: sessional workload data (GPS derived distance, sprint distance, max velocity) from 60 players over 3 seasons
  + Univariate and multivariate Poisson regression models were used to find incident rate ratios
  + Model performance was evaluated using ROC (AUC)
* Results: very low and very high exposures to >85% of a player’s max velocity over the previous 8 weeks were associated with greater injury risk compared to moderate exposure, with model performance of AUC = .64 (which isn’t very good imo)
* Minimal exposure to high velocity efforts was associated with the greatest injury risk. Being under-loaded may be a mediator for non-contact injury. Pre-season workload and playing experience weren’t moderators of this effect
* Overall, these results make me suspicious. Not sure if we should really trust them, seeing as their results really weren’t that good

*Physical Exam Risk Factors for Lower Extremity Injury in High School Athletes: A Systematic Review*

* Objectives: identify clinical assessment tools demonstrated to effectively determine lower extremity injury risk in a prospective setting & critically asses the methodological quality of prospective lower extremity risk assessment studies that use these tools
  + They basically did a literature survey
* 9 studies were looked at
  + Identified risk factors fell into 7 basic categories: balance, anatomy, strength, physical maturation status, weight, and ligamentous laxity
  + They also go into detail on why they think each of these 7 categories are significant
* Overall, this is a decent paper to reference to when we talk about what variables are important in injury prediction. It also has a LOT of sources in it that we could also point to if needed

*A Model of Stress and Athletic Injury – Prediction and Prevention*

* In short, this covers how stress related factors can affect injury occurrence
* It also talks about the necessity to thoroughly investigate these different sources of stress, how they play on one another, and what they actually mean for the player
* I feel this is somewhat accomplished by the OWI and SFI tests in our data

*Free Communications, Oral Presentations: Lower Extremity Movement Screening and Injury Prevention*

* Objective: identify pre-participation screening measures that demonstrate a substantial association with subsequent CLEI for high school football players
* Outcome Measures: retrospective and prospective analyses were performed to assess associations between screening measures and injury
  + Retrospective injury = any CLE sprain or strain resulting in sport time loss
  + Prospective injury = any CLE sprain or strain during the season that required evaluation and treatment
* Also used a Sport fitness index (SFI) score in their testing to quantify persisting effects of previous injuries
* Prediction models were made from ROC and logistic regression
* Conclusion: pre-season screening results can be used to estimate the injury risk level of individual high school football players

*Injury Prediction in Veteran Football Players using the Functional Movement Screen*

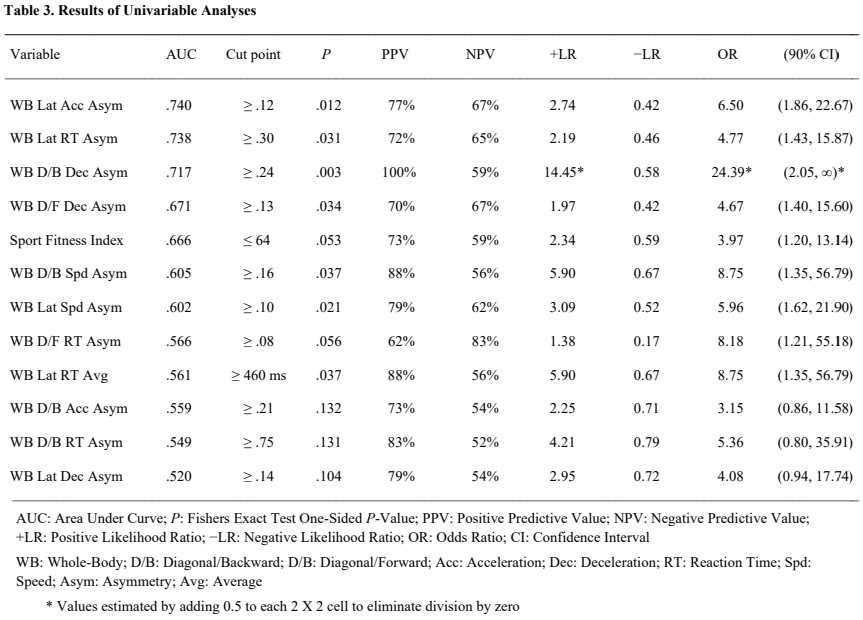
* The main take away for this, I think, is that they also used a sort of Movement based screening for injury prediction (similar to the lateral and horizontal movement tests Gary did)
* But, these are on veteran football players (age >32), not high school and college students
* Maybe not a good paper for a direct comparison, but good to bring attention to if we end up using those movement based variables in the study

*Data Preparation for Injury Prediction*

* The stuff in here is pretty obvious, but it’s another source we can point to

*Association of Concussion History with Neuromechanical Responsiveness Asymmetry*

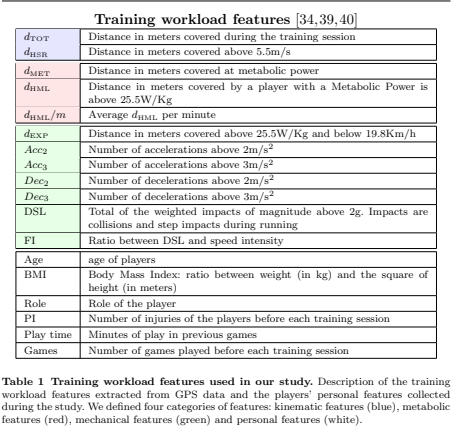
* Goal: derive a generalizable statistical model for identification of athletes who possess subtle alterations in sensorimotor processes that may be due to previous concussions
* Tested in residential Olympic training center sports medicine clinic
* Consisted of a primary cohort of 35 elite athletes, and a second cohort of 40 different elite athletes who performed identical tests the preceding year
* Testing done: 2 upper extremity tests of visual-motor reaction time and 2 tests of whole-body reactive agility
  + Whole body test required lateral or diagonal responses to VR targets
* Outcome:
  + Sport-related concussion history (SRC Hx) which was reported by 54% of the primary cohort athletes, and 45% of the second cohort athletes
* Results: univariate analysis identified 12 strong predictors of SRC Hx (see table below)



* Conclusions: asymmetry in whole-body reactive movement capabilities may be a manifestation of a subtle abnormality in the functional connectivity of brain networks that might be relevant to previously reported associations between SRC Hx and musculoskeletal injury occurrence

*Effective Injury Prediction in Professional Soccer with GPS Data and Machine Learning*

* Uses GPS measurements and machine learning to predict injury occurrence in soccer players
* GPS is used to collect workload of players during a season (workload seems to be a common area of interest in these papers)
* They monitored the physical activity of players during 23 weeks of training sessions
* Used tools like GPS tracker, 3-d accelerometer, 3-d gyroscope, and 3-d digital compass
* Features used in study:



* They broke down their approaches as follows:
  + ACWR (acute chronic workload ratio): the ratio between the acute workload and the chronic workload of a player
  + MSWR (mean standard deviation workload ratio): the ratio between the mean and the standard deviation of a player’s workload obtained in 1 week
* They have a decision tree model named Call, but I can’t find a direct explanation of what it is