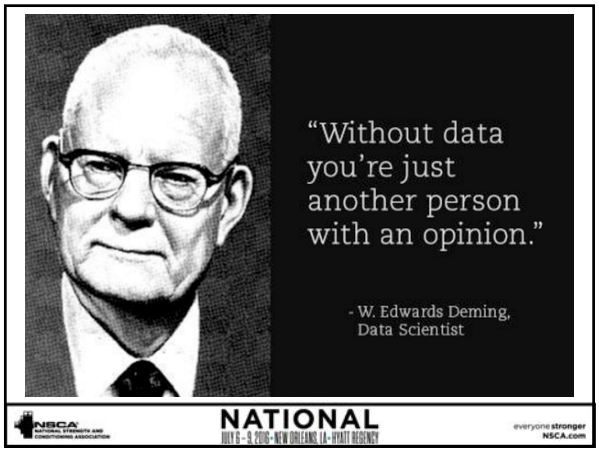
PLAYER MONITORING & SPORTS SCIENCE IN PROFESSIONAL SPORTS

Patrick Ward MS, CSCS



OBJECTIVES

- Overview of the sports science framework within team sport
- Discuss tools for monitoring athletes
- Discuss basic analysis concepts

SPORTS SCIENCE FRAMEWORK

WHAT SPORTS SCIENCE *IS NOT*

- The answer to your injury problems
- Sports technologies
  - Technology and analysis don't solve problems. *People* solve problems.
  - Be skeptical of black boxes
- Charts and graphs

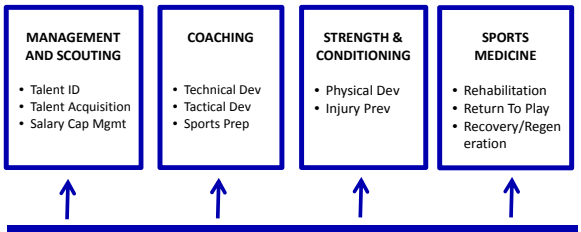
WHAT SPORTS SCIENCE *IS*

Sports Science is the utilization of current scientific evidence and collected data to help key stakeholders make informed decisions about the health and well-being of an athlete.

WHAT DOES A SPORT SCIENTIST DO?

- Conduct scientific investigations of athlete-generated data
- Set up best practice methods for data collection
- Contextualize and analyze data
- Appraise sports technologies to determine their use (if they are even useful at all)
  - Reliability
  - Validity
  - Signal-to-Noise

FRAMEWORK



RATIONALE FOR MONITORING

- Understand training and performance
  - Not all athletes respond the same way.
  - Are we getting what we want from the training program?
- Provide useful (objective) analysis
  - Help make informed decisions on program adjustments.

THE COMPLEXITY OF TEAM SPORT

- Lots of athletes on a team
  - More challenging to individualize loads
- Frequent competitions
- Not everyone competes
- Performance is dependent on the opposition

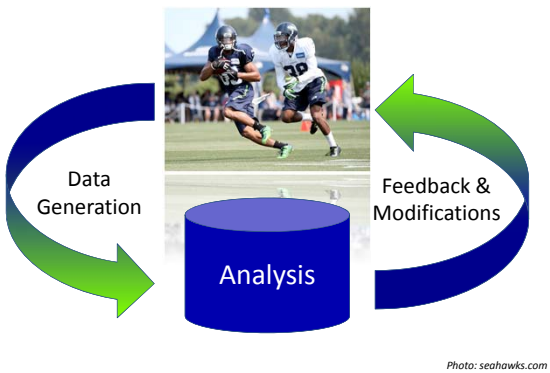
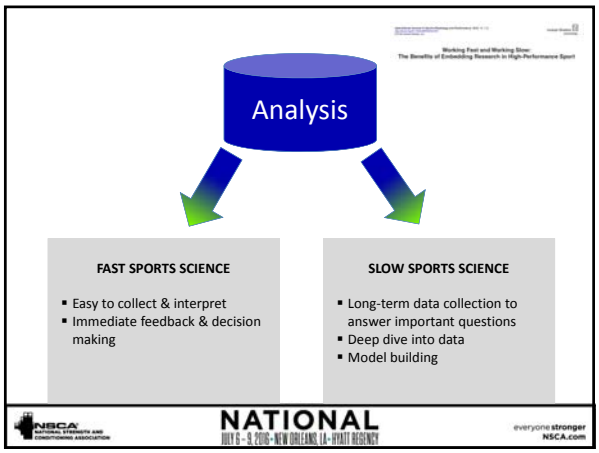


Photo: seahawks.com



DATA COLLECTION METHODS

VARIOUS STREAMS OF DATA

TRAINING DATA

- Integrated Microtechnology
- Heart Rate
- Rating of Perceived Exertion (RPE)
- Power Output
- Training Volume (total tonnage)
- Bar Velocities

WELLNESS DATA

- Wellness Questionnaires
- Sleep
- Nutrition
- Heart Rate Variability
- Blood/Saliva

WHAT DATA SHOULD WE COLLECT?

- What makes sense in your environment?
  - Team culture
- Cost
- Time
- Ease of collection and analysis
- Usability of the data
- Signal to Noise
  - Is the technology you are using so noisy that you can't detect a signal?
  - Stop wasting time!

QUANTIFYING TRAINING LOAD:
Rating of Perceived Exertion

- BORG CR10 Scale
- Anchor the athletes to the verbiage first
- Record session RPE following the training session
  - ~15-30min post training session?
  - Maybe we don't need to wait?!
- Coach's RPE vs Players' RPE

Int J Sports Physiol Perform. 2013 Nov 13. [Epub ahead of print]

Coaches' and Players' Perceptions of Training Dose: Not a Perfect Match.

Brink MS, Frencken W GP, Jordet G, Lemmink KA.

Author Information

Abstract

PURPOSE: The aim ... ull competitive season.

METHODS: Session ... ional soccer players (height 178,2 ... h the planned periodization of their ... and duration (minutes) for each pl ...

RESULTS: Players ... y their coaches (P < 0.0001). The correl ... 0001). Furthermore, for coa ... 1). For hard days as intended by the c ... e U17 squad perceived training sessions harder than se... < 0.0001).

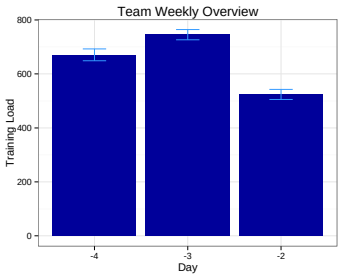
The results indicate that young elite soccer players perceive training harder than what was intended by the coach. These differences could lead to maladaptation to training. Monitoring of the planned and perceived training load of coaches and players may optimize performance and prevent players from overtraining.

CONCLUSION: The results indicate that young elite soccer players perceive training harder than what was intended by the coach. These differences could lead to maladaptation to training. Monitoring of the planned and perceived training load of coaches and players may optimize performance and prevent players from overtraining.

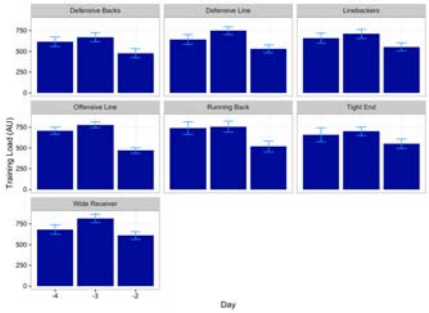
Training Load = Session RPE * Training Duration in Minutes

BORG CR10	
Score	Perception
10	Maximal
9	
8	
7	Very Hard
6	
5	Hard
4	Somewhat Hard
3	Moderate
2	Easy
1	Very, Very Easy
0	Rest

WEEKLY TRAINING LOAD



WEEKLY TRAINING LOAD BY POSITION



INTEGRATED MICROTECHNOLOGY

- GPS → Position
- Gyroscope → Rotations
- Magnetometer → Direction
- Accelerometer → G-forces (3 axes)

THE VALIDITY AND RELIABILITY OF GLOBAL POSITIONING SYSTEMS IN TEAM SPORT: A BRIEF REVIEW

The Reliability of MinimaxX Accelerometers for Measuring Physical Activity in Australian Football

Luke J. Boyd, Kevin Ball, and Robert J. Aughey

POSITIONAL PROFILES

Table 3. Offense positional movement profiles.*

Movement variables	Wide receiver (WR)	Running back (RB)	Quarterback (QB)	Tight end (TE)	Offensive linemen (OL)
Running zone distances					
Total distance (m)	5,530.6 ± 996.5	3,140.6 ± 685.6†	3,751.9 ± 801.9†	3,574.2 ± 882.2†	3,652.4 ± 603.0†
Low intensity distance (m)	3,546.2 ± 756.2	2,291.3 ± 482.0†	3,661.5 ± 642.2‡	2,579.2 ± 663.8†§	2,885.4 ± 663.8†‖§
Moderate intensity distance (m)	1,530.9 ± 341.2	738.4 ± 247.2†	568.3 ± 147.8†	947.2 ± 155.5†‖§	913.2 ± 147.8†‖§
High intensity distance (m)	655.2 ± 196.3	303.1 ± 118.7†	138.1 ± 65.1†‖	336.5 ± 137.8†§	131.1 ± 65.7†‖
Sprinting distance (m)	315.8 ± 163.2	101.2 ± 71.7†	76.9 ± 46.0†	40.3 ± 47.4†	9.3 ± 11.3†‖
Average maximal speed (km·h⁻¹)	31.5 ± 2.2	28.8 ± 2.5†	29.4 ± 8.5	25.3 ± 7.8†§	23.7 ± 2.8†§
High intensity movement efforts					
Sprint efforts (#)	12.7 ± 5.7	4.6 ± 3.1†	2.8 ± 1.9†	1.5 ± 1.6†‖	0.3 ± 0.5†‖
Moderate acceleration efforts (#)	62.2 ± 14.0	26.3 ± 11.2†	26.8 ± 5.1†	49.0 ± 19.7†§	46.7 ± 13.5†§
High intensity acceleration efforts (#)	38.2 ± 13.1	18.7 ± 7.7†	21.0 ± 7.8†	21.5 ± 14.3†	16.5 ± 5.9†
Maximal acceleration efforts (#)	21.9 ± 8.1	8.2 ± 4.9†	9.3 ± 5.9†	5.5 ± 4.1†	1.5 ± 1.6†‖§
Moderate deceleration efforts (#)	36.9 ± 14.0	15.6 ± 7.2†	22.2 ± 7.5†	22.0 ± 8.5†	25.1 ± 7.1†‖
High intensity deceleration efforts (#)	18.5 ± 13.1	7.9 ± 7.7†	9.7 ± 7.8†	9.3 ± 14.3†	8.3 ± 5.9†
Maximal deceleration efforts (#)	15.8 ± 5.4	6.4 ± 3.5†	6.3 ± 3.4†	4.7 ± 3.9†	6.6 ± 2.0†§

*Data are mean ± SD.
†Significantly different ($p \leq 0.05$) for WRs.
‡Significantly different ($p \leq 0.05$) to RBs.
§Significantly different ($p \leq 0.05$) to QBs.
‖Significantly different ($p \leq 0.05$) to TEs.

QUANTIFICATION OF COMPETITIVE GAME DEMANDS OF NCAA DIVISION I COLLEGE FOOTBALL PLAYERS USING GLOBAL POSITIONING SYSTEMS

"What should our training targets be?"

LONG-TERM EVALUATION

SIMPLE METHODS FOR QUANTIFYING FATIGUE

- ***How do you feel today?***
- Quantify the response
  - RESTQ-Sport
  - Recovery-Cue
  - Profile of Mood States

	5	4	3	2	1	Record Score
FATIGUE	Very fresh	Fresh	Normal	More tired than normal	Always tired	
SLEEP QUALITY	Very restful	Good	Difficulty falling asleep	Restless sleep	Insomnia	
GENERAL MUSCLE SORENESS	Feeling great	Feeling good	Normal	Increase in soreness/tightness	Very sore	
STRESS LEVELS	Very relaxed	Relaxed	Normal	Feeling stressed	Highly stressed	
MOOD	Very positive mood	A generally good mood	Less interested in others &/or activities than usual	Snappiness at team-mates, family and co-workers	Highly annoyed/ irritable/down	

Neuromuscular, Endocrine, and Perceptual Fatigue Responses During Different Length Between-Match Microcycles in Professional Rugby League Players

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Daily Wellness

	Energy	Sleep	Soreness	Stress	Total Wellness
Player 1	Normal	Normal	Green	Normal	Normal
Player 2	Yellow	Normal	Red	Normal	Yellow
Player 3	Normal	Red	Red	Normal	Red
Player 4	Normal	Normal	Normal	Normal	Normal
Player 5	Normal	Normal	Normal	Normal	Normal
Player 6	Normal	Normal	Red	Normal	Normal
Player 7	Normal	Normal	Normal	Normal	Normal
Player 8	Normal	Normal	Yellow	Normal	Normal
Player 9	Normal	Normal	Red	Green	Normal
Player 10	Normal	Normal	Normal	Green	Normal
Player 11	Normal	Normal	Green	Green	Green
Player 12	Green	Normal	Normal	Normal	Normal
Player 13	Normal	Red	Normal	Normal	Normal
Player 14	Normal	Normal	Green	Normal	Green
Player 15	Red	Normal	Red	Normal	Red

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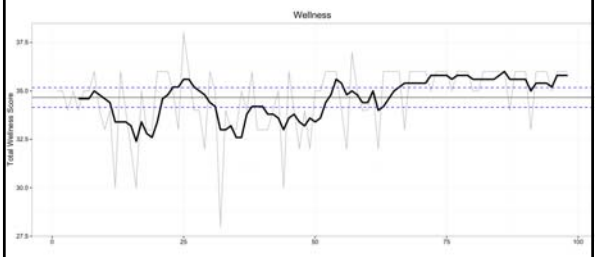
LONG-TERM WELLNESS TREND



DATA ANALYSIS

INITIAL PROCEDURES

- How *clean* is the data you are about to analyze?
- Produce graphics and visualizations
- Produce summary statistics
  - Provides a compass for the analysis
  - Mean, Median, SD
  - Look at distributions of the data, outliers, missing values, etc
  - Context is everything!
    - *"Raw data are rarely useful because data are just an input, with no analysis or context."* -Alamar (2013)

WHAT ARE YOU TRYING TO DO?

- **Describe something**
  - Validity or reliability of a test or technology
  - Practice or game demands
  - Player profiles
  - Inter-individual differences
- **Predict something**
  - Performance outcomes
  - Potential for future success or ability
- **Classify something**
  - Players based on training or physical profiles
  - Players based on injury risk

STEPS IN THE ANALYSIS PROCESS

1. Start with a good question.
2. Determine the necessary data streams.
3. Determine the analysis that will answer the question.
4. Contextualize the data to help others understand.
5. Turn data into action
   - *"All decisions should be based on evidence, but the best decisions should also be based on previous experience."*
     –James Stone
6. Iterate the model

SUMMARY

- Collect data that is meaningful
- Take a *fast* and *slow* approach to sports science
- Be objective
  - *"People operate with beliefs and biases. To the extent you can eliminate both and replace them with data, you gain a clearer advantage."* – Michael Lewis, Moneyball
- Set up analysis approaches that answer important questions
- Continually develop and iterate the model
  - All models have limitations and uncertainty

THANK YOU

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