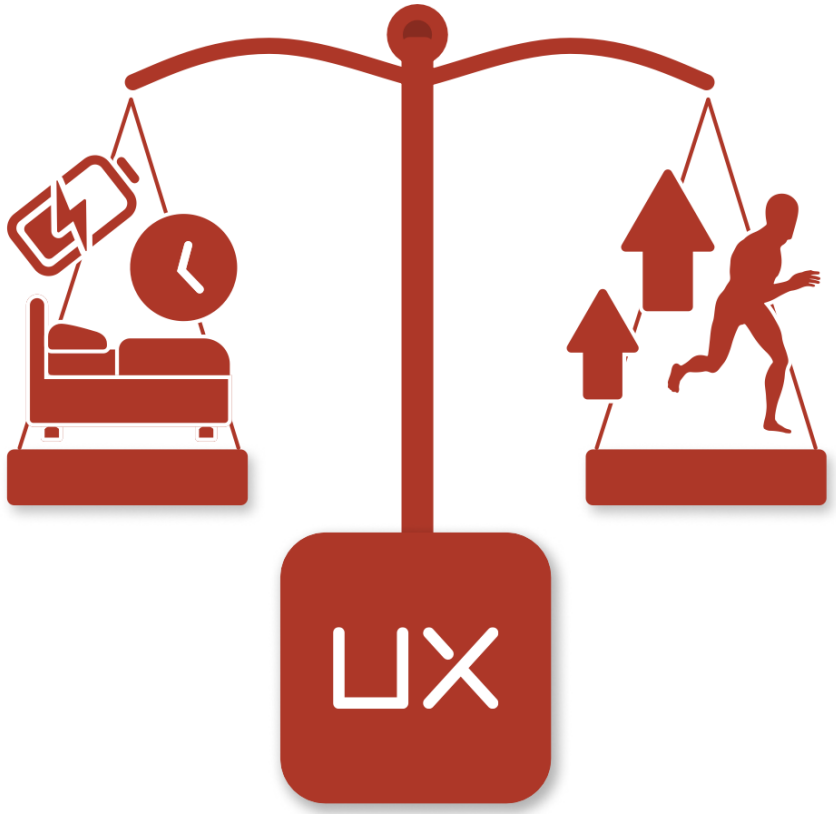
Physical Load Management Strategies

Establishment of the Monitoring System



by Marko Matušinskij

Sport

Second and First Division youth
Third Division Senior Team

Education

University of Kinesiology
ASCA LVL 2
EXOS
Football Science Institute
Partial Python Developer
ISSPF Monitoring and
Ltad
Barca HUB monitoring
UEFA B

Work

NK Lokomotiva - u12/u19
NK Istra First Team - Head of Academy
NK Rudeš - u19 and
First team-Head of academy
Dinamo B Team
Dinamo u19
Dinamo Head of Academy
Dinamo First Team
Women National Team u15/u17/u19/A
U21 men Team
Women Team Dinamo
A team
Head of Performance
Ultrax Sport Consultant
Baskonia - Alaves

Academical

University of Kinesiology assistant
CFF Lecturer UEFA B,A
Licence Lecturer
FSI Lecturer
CEO Ultrax HUB
Conference Lecturer

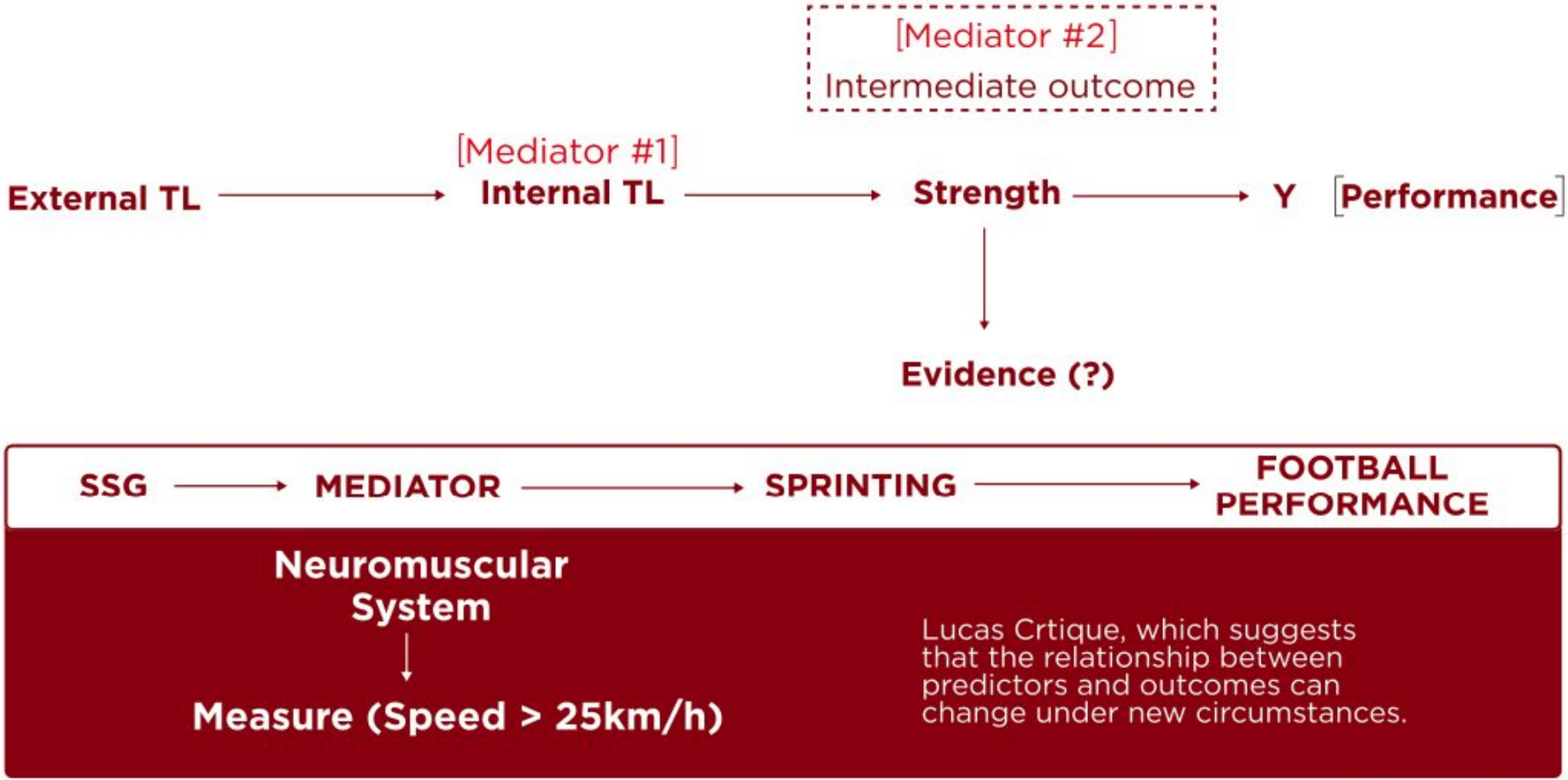
Što kažu treneri?

Želim što spremnije sportaše!

Želim trenirati do njihovih granica!

Ne želim ozljede!

??

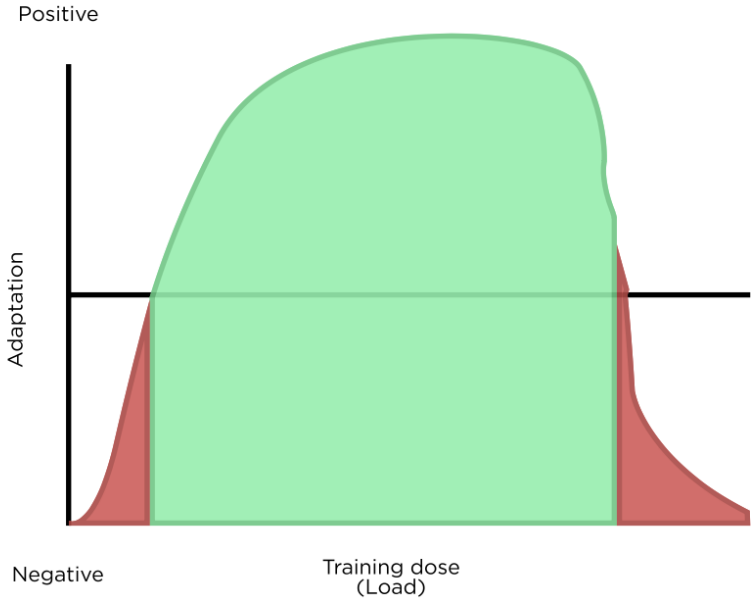


Franco Impellizzeri

Where is the ceiling?

“Injuries impair team performance, but any injuries that could potentially be considered "training load related" injuries are commonly viewed as "preventable" and therefore the domain of the sport science and medicine team.”

- Gabbet, 2015



Hormesis effect of training load

Činjenice?

Igrači koji su imali prethodnu ozljedu značajno su u većem riziku za novu ozljedu. SpringerOpen+1

Nagli porast opterećenja („spike“ u trening load-u) povezan je sa povećanim rizikom od ozljeda. bjsm.bmj.com+1

Visoka monotonija (nedostatak varijabilnosti u opterećenju, bez dana sa smanjenim opterećenjem ili odmora) također je identificirana kao rizičan faktor za ozljede. Frontiers+1

Sustavna periodizacija i monitoring treninga (uključujući praćenje akutnog i kroničnog opterećenja) značajno pridonose smanjenju rizika od ozljeda i ostvarivanju optimalne forme. SpringerLink+1

Subjektivni pokazatelji kao što su „wellness“ ankete i RPE (Rate of Perceived Exertion) pokazali su se korisnima za prilagodbu treninga igračima i potencijalno za smanjenje ozljeda. bjsm.bmj.com+1

Činjenice?

Povećanje **RSI-a** u *single-leg hop testu* i **jakosti ekstenzora kuka** za **4–6 %** može povećati sposobnost ubrzanja i kočenja za oko **4 %**.

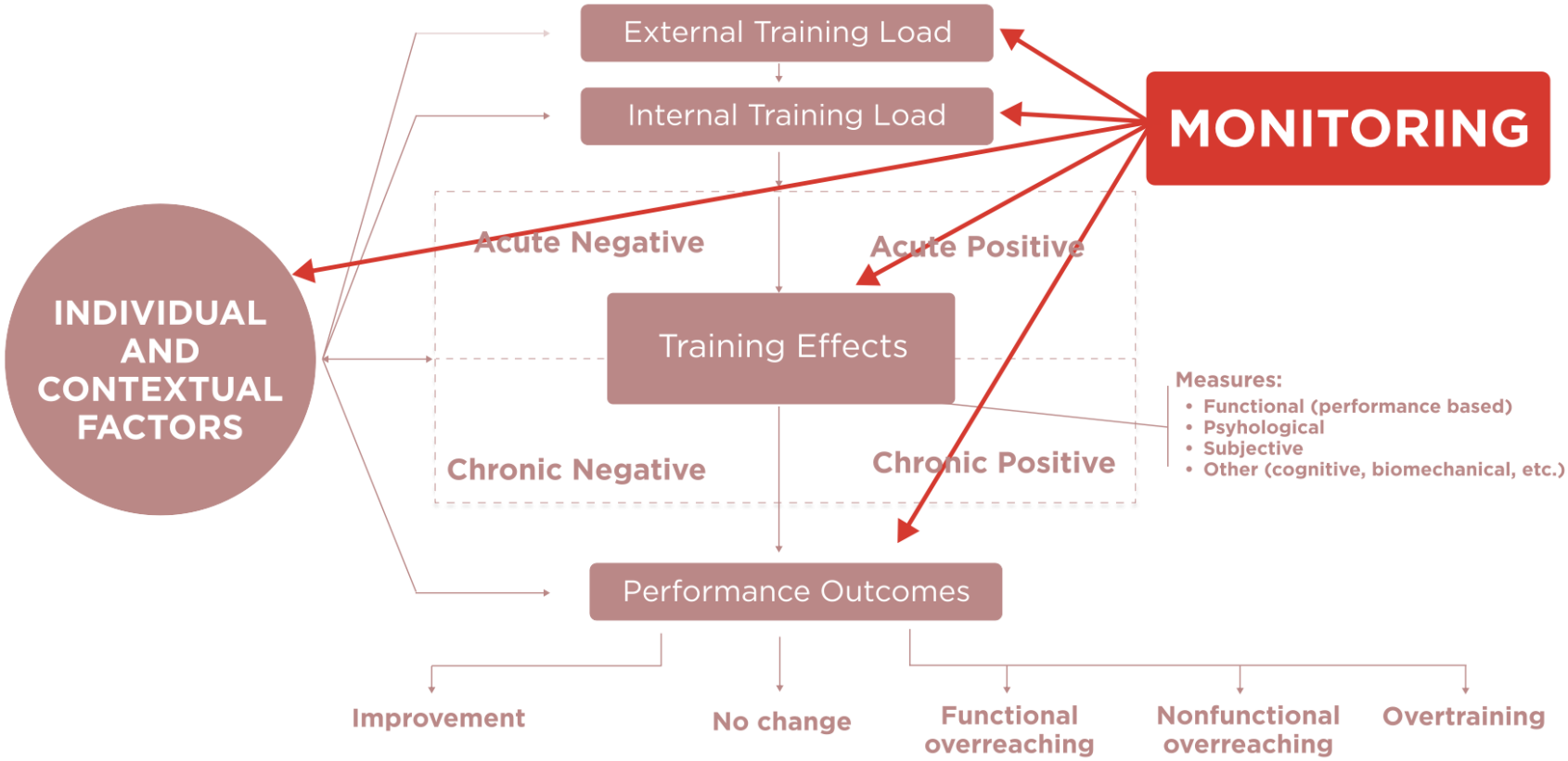
Oko **30 minuta u crvenoj zoni (>90 % HRmax)** dovoljno je za **održavanje aerobnog fitnessa** kod nogometaša.

Svakih dodatnih **10 minuta rada u toj zoni** povećava aerobni kapacitet za **3–5 %**.

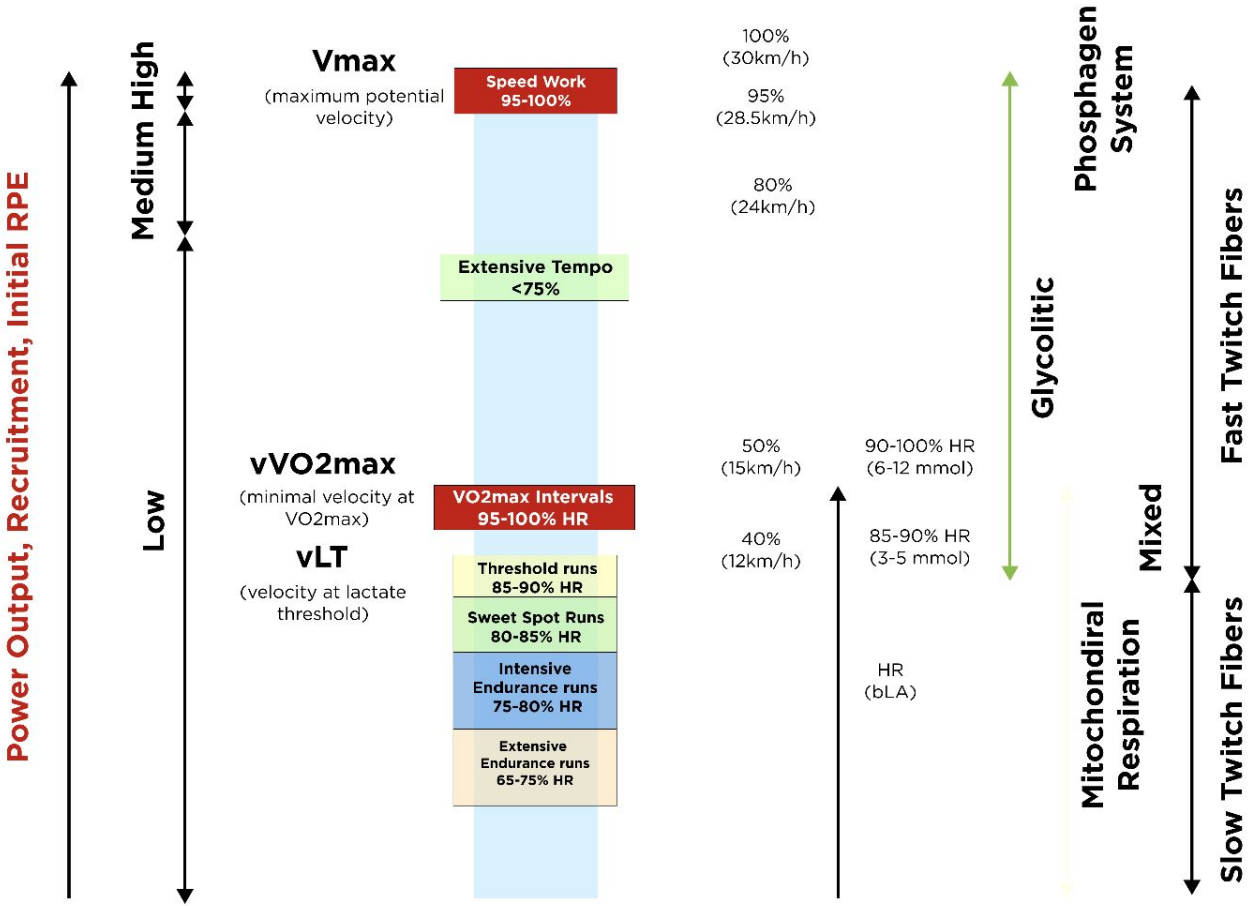
Smanjenje pulsa u mirovanju za **5–10 otkucaja/min** ili niža vrijednost pulsa u **submaksimalnom testu** pokazatelj je **pozitivne adaptacije**.

U **Monoghi testu** (trčanje istom brzinom u istim uvjetima) – **niža koncentracija laktata** znak je **poboljšanje aerobne učinkovitosti** i bolje sposobnosti oporavka.

What to monitor?



Energy System Continuum



Mladen Jovanović, 2011

P.E.I.R.C.

- **Plan** (Training Program - External Load)
- **Evaluate** (External Load Data - Objective & Subjective)
- **Internal Load** (Monitor Internal Responses)
- **Recovery** (Next Day Response & Wellness Feedback)
- **Check Readiness** (Current State of Readiness)

- Best Practice and tradition
- Scientific literature
- Opinion of the wisdom
- Heuristics
- Current state
- Intuition and preferences
- Objectives
- Previous experimentation
- Barbell Strategy
- Randomization
- Robust
- Is-ought - experiment

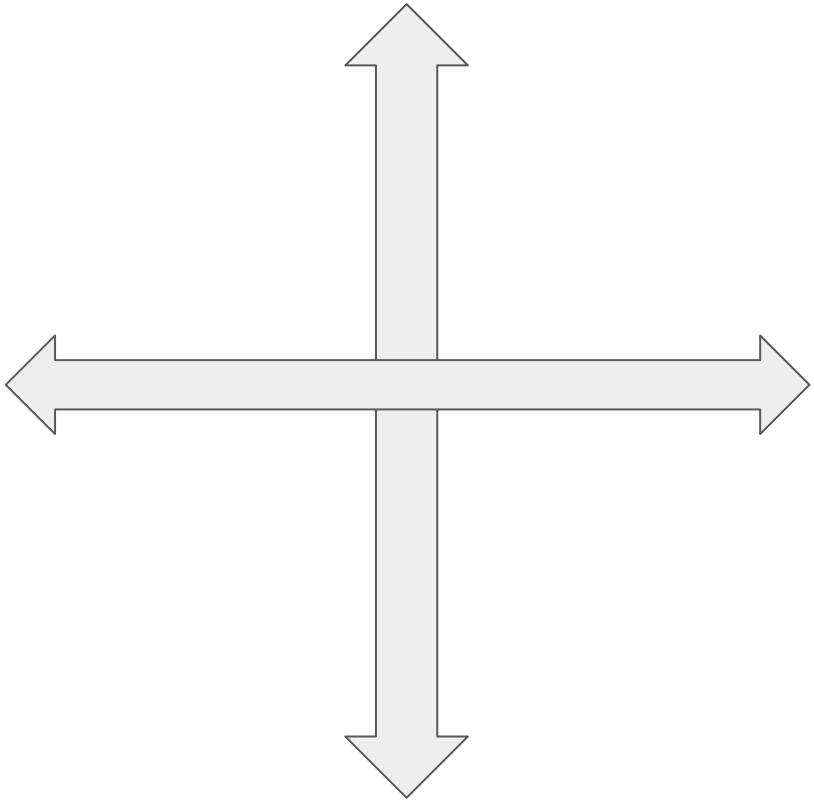
Parametar	Trening A	Trening B
Tip treninga	10v10 na pola terena (posjed + pressing)	5v5v5 rondo s kontinuiranim rotacijama
Trajanje	2×20 min	2×20 min
Ukupna distanca (GPS)	5.600 m	5.500 m
High-speed running (>19.8 km/h)	220 m	240 m
Sprint distanca (>25 km/h)	50 m	60 m
Broj ubrzanja (>2.5 m/s²)	38	41
Broj kočenja (<–2.5 m/s²)	37	40
Prosječni HR	83% HRmax	82% HRmax
HRpeak	92% HRmax	91% HRmax
RPE (0–10)	**8.0**	**5.5**
Mentalni zamor (0–10)	**8.5**	**4.0**

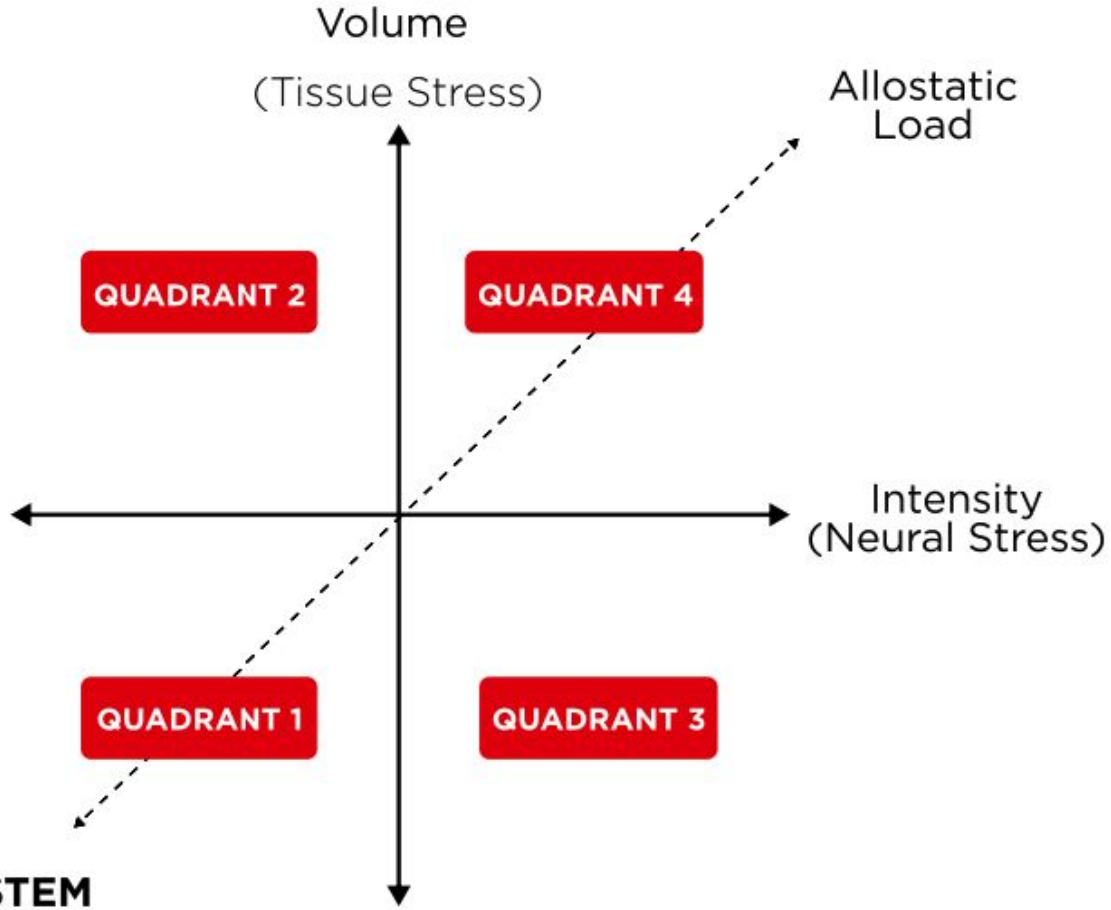
Problem 1. Što je opterećenje?

Što definira **opterećenje** u **vašem** sportu?

Što od parametara i **reakcija** trenutno pratite?

Što bi htjeli pratiti a niste sigurni kako?

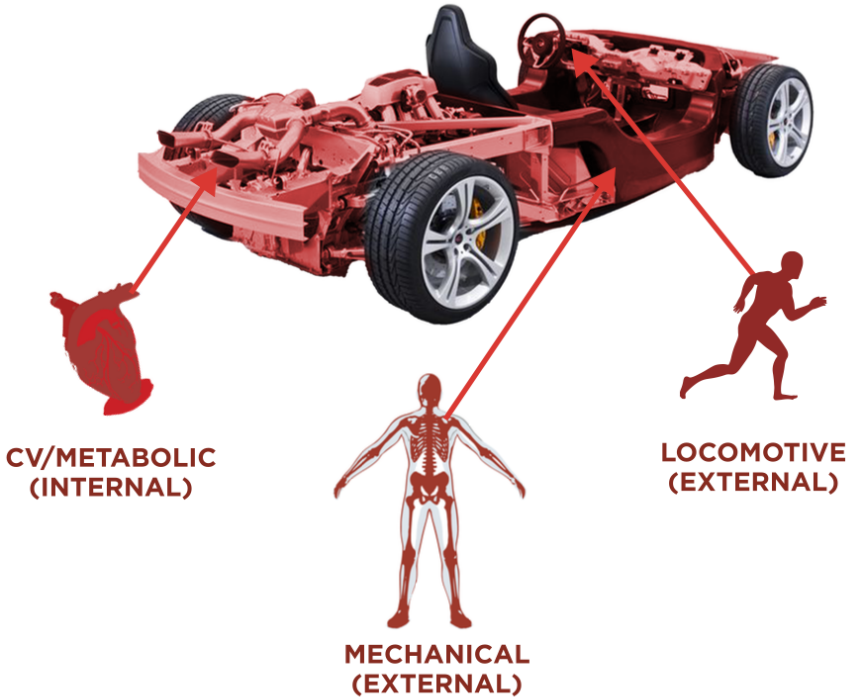




THE QUADRANT SYSTEM

Daniel Bove

Halson (2014) sugests that the variables and indicators chosen to quantify training load should cover a broad range of dimensions to ensure a comprehensive understanding of the demands placed on athletes.

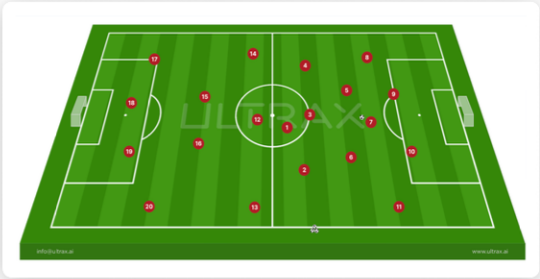


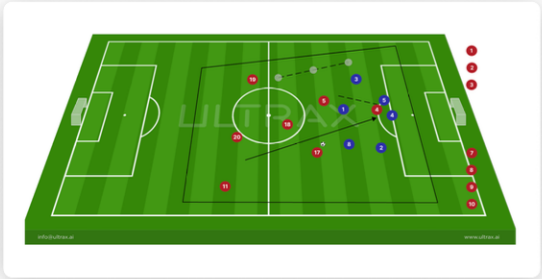
4v4 format induced players greater distance coverage and speed compared to 2v2 format **(Clemente et al / Mandorino et al., 2024)**

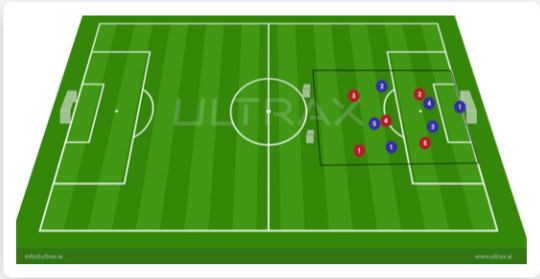
Higher overall running intensity during 10v10 compared to 8v8,6v6,4v4 format **(Mandorino et al., 2024)**

Increasing area per player = higher locomotor (mechanical) demands

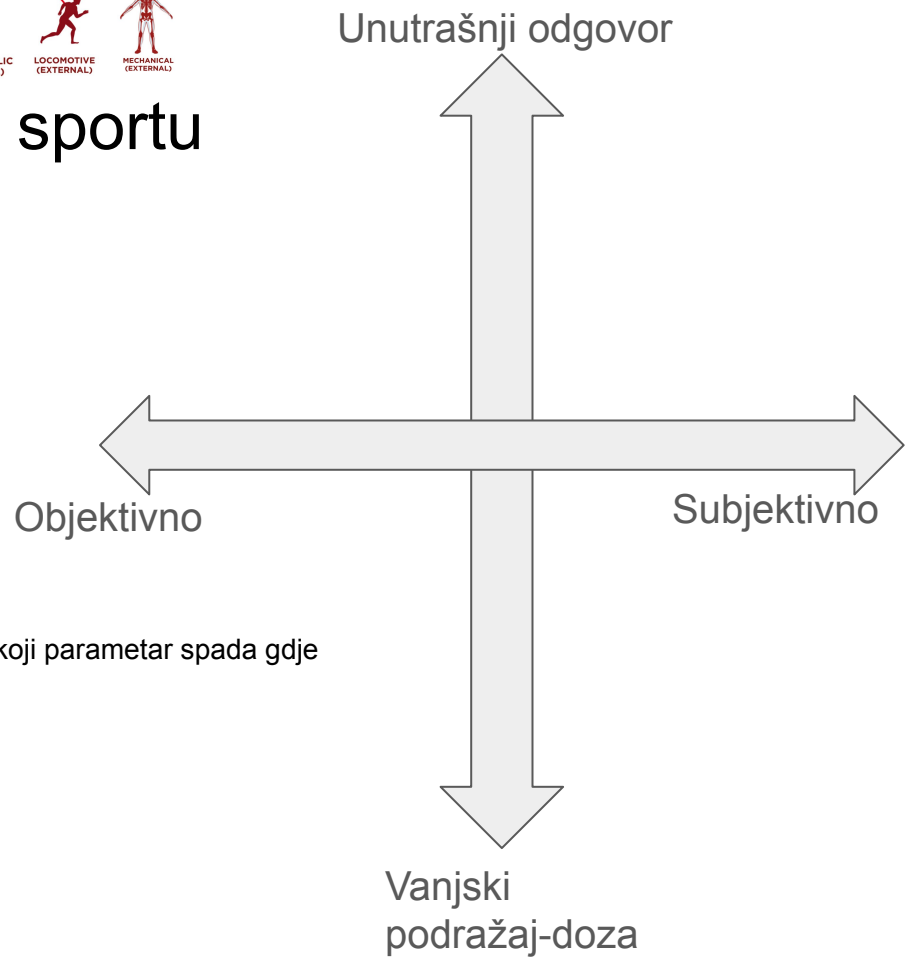
By reducing the size of the pitch, Gaudiono et al., registered a more significant number of moderate acc and decelerations **(Mandorino et al., 2024)**







Problem 2. Doza-reakcija, odnosno opterećenje u vašem sportu



Podijeliti ćemo se u 4 grupe

- Endurance (rowing, swimming, cycling,triathletes)
- Skill-dominant (archery, gymnastics,figure skating)
- Power (athletics, wrestling, weightlifting)
- Mix (team sports)

Svaka grupa treba definirati:

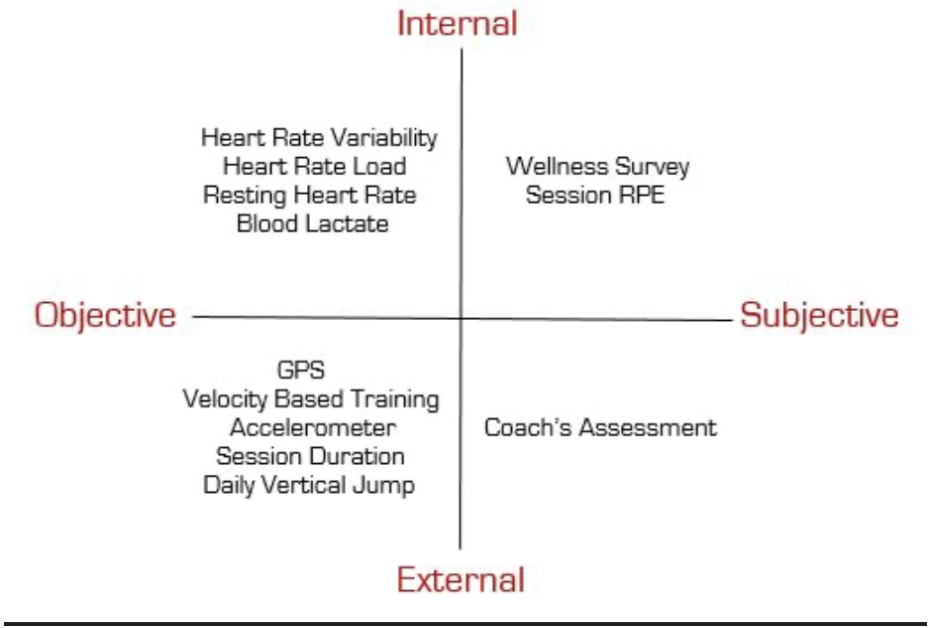
1. Što u vašem sportu predstavlja vanjsko opterećenje? - Doza?
2. Što bi naveli kao unutarnje opterećenje? - Odgovor sportaša?
3. U kvadrantu objektivno-subjektivno-unutarnje-vanjsko navedite koji parametar spada gdje

Ponuđeni odgovori:

Trenerova procjena, bacanje medicinke,subjektivna procjena sportaša

Heart rate variability, heart rate, laktati, tempo, vrijeme na zadanoj udaljenosti, skok u dalj

Puls u mirovanju, wellness upitnici (kvaliteta sna, zamor), trajanje treninga-sadržaja, broj skokova



Možemo li po grupama kreirati svoj parametar za sport?

Primjer:

Veslanje: snaga u W x trajanje podražaja x RPE = ?

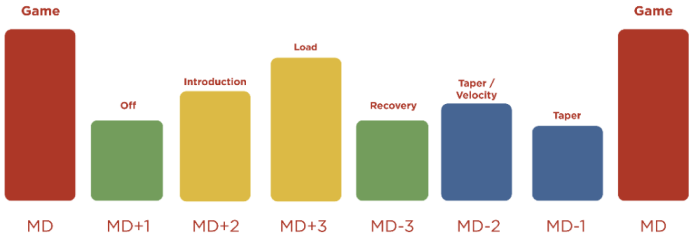
Gimnastika: broj skokova u treningu x RPE ?

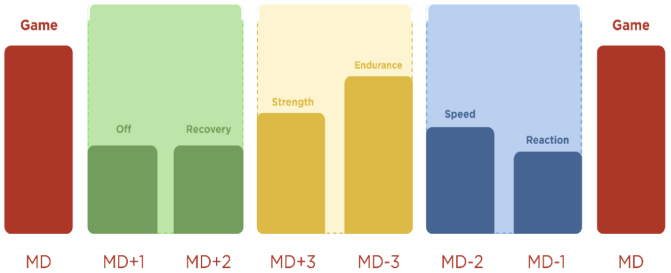
Nogomet: broj dugih lopti x RPE

Broj dugih lopti prosjek zadnja 4 tjedna / broj dugih lopti zadnjih 7 dana (navika)

Dose-response” paradox — *same dose ≠ same adaptation.*

RPE (0–10)	8.0	5.5
Mentalni zamor (0–10)	8.5	4.0





Opterećenje nije samo ono što se **propisuje**, već ono na što se sportaš **odgovara i adaptira**.

Markers for tracking individual condition

Rate of Perceived Exertion (RPE) is a subjective measure of the intensity of physical activity.

It is based on the individual's perception of their own effort, rather than objective measures such as heart rate or oxygen uptake.

RPE is typically measured on a scale of 1-10 or 6-20, with 1 or 6 indicating very light exertion and 10 or 20 indicating maximal exertion.

The scale can be further modified to include descriptors such as "moderate" or "hard."

March 2023

marko.matusinskij@ultrax.ai

RPE in a practical environment - Gathering of the RPE data

- 15 to 30 minutes after the training session
- Asking the question: "*How hard was the session?*"
- **SRPE =** Players RPE x training duration in minutes
- **SRPE =** 7 x 90 minutes
- **SRPE =** 630 arbitrary units (AU)

marko.matusinskij@ultrax.ai

How I use RPE

RPE in Monitoring Training Session Reactions in Soccer

Study on Multifaceted Effects of Workload in Female Soccer Athletes by Hegedusich (2023) explored the relationship between RPE and volume load in Division 1 female soccer athletes, providing insights into how RPE correlates with performance and workload in a soccer setting.

RPE in Strength and Endurance Programming in Soccer

Unfortunately, there were no specific recent studies found detailing the use of RPE in strength and endurance programming for soccer within the search constraints.

RPE in Readiness for Soccer

Study on Internal Load Responses and Recovery in U19 Soccer Players by Pilliteri et al. (2023) utilized RPE scale assessments for internal load and recovery/availability evaluations, highlighting the application of RPE in assessing soccer players' readiness for training and matches

RPE in Soccer Rehabilitation

Study on Indicators Associated with Training Load and Competition as Injury Risk Factors by Talvari et al. (2023) did not find direct predictive value of RPE for injury in elite soccer players but highlighted the physical pressures endured by soccer players and the potential role of monitoring tools like RPE in managing injury risks.

RPE in Soccer Periodisation and Progression

There were no specific findings detailing the use of RPE in periodization and progression strategies in soccer from the recent literature within the search constraints.

RPE Variables in Soccer

Effects of Anodal Transcranial Direct Current Stimulation on Soccer Player Performance by Rocha et al. (2024) explored the performance variables in relation to RPE, providing insights into physiological responses and perceived exertion levels in soccer players peters variates golia nine tomore in eme peele late out tal a com ported on RP post match and is corelation with echniel and tactical

Understand your off season period

Step 1

- Start with the last week load
- Use the **10% rule**
- Your preseason should lean on off season: Last week

Player	Last week of off-season	10% INCREASE	10% DECREASE
M.M.	2500	2750	2250
I.M.	2000	2200	1750

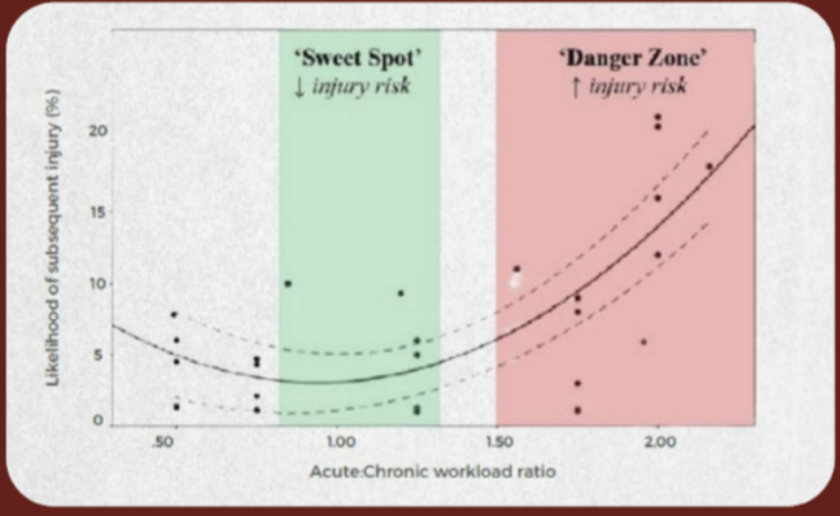
marko.matusinskij@ultrax.ai

Understand your off season period

Step 2

- Use the ACWR safe zone
- When you build your chronic workload (two or more weeks), you can use acute to chronic workload relationship approach to plan training load

Hint: divide your training week of 7 days in two small cycles.



marko.matusinskij@ultrax.ai

- Assuming the athlete completed the 2450 units in one week, we can calculate the target load for the next week by multiplying it with 1.3:
- Target load for next week = 2450 x 1.3 = 3185 units (rounded up)

marko.matusinskij@ultrax.ai

Understand your off season period

Step 3

- **Training load reserve (Svilar, 2022.)**
- Training load reserve = chronic load - accumulated acute load

marko.matusinskij@ultrax.ai

Variable	Low	Medium	High
Training Session Duration	<60	60-80	>80
Training drill duration	1-4	4.5-8	>8.5
Session RPE	1-4	4-6	7-10
Arbitrary units	Depends on RPE and Duration <300	Depends on RPE and Duration 300-500	Depends on RPE and Duration >500
Weekly load	AU >1500	AU 1500-2500	AU >2500
ACWR	<0.8	0.1-1.3	>1.3
Monotony	<1.5	1.5-2.5	>2.5
Week to week change	10%	15-20%	>25%
Strain			

- Training session duration
- Training drill duration
- Session RPE gym
- Session RPE endurance
- Arbitrary units TQR
- Sleep quality
- Sleep duration
- Muscle soreness
- Readiness to train
- Mood
- ACWR
- Monotony
- Freshness
- Week to week change
- Strain

Load Mapping Game

Cilj: Primijeniti i vizualizirati logiku opterećenja.

Korak 1:
Svaka grupa dobiva prazan tjedni planer (7 dana) i mora osmisliti **trenažni mikrociklus** za svoj sport.

Definiraju:

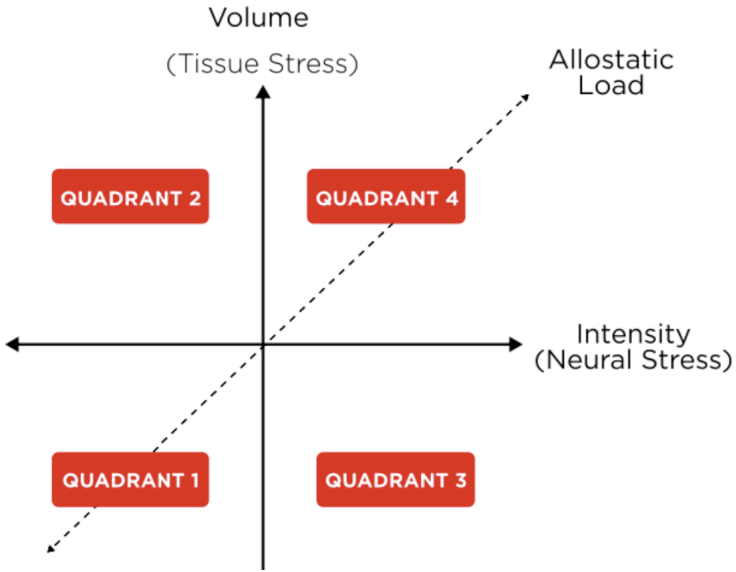
- Tip treninga (tehnički, jakost, energetika, regeneracijski, slobodan dan)
- Očekivani RPE
- Trajanje (min)
- **Ukupno opterećenje = RPE × Trajanje**

PON	UTO	SRI	ČET	PET	SUB	NED
Jakost						NATJECANJE
90 - volume						PB
7- intensity						TESTING DAY
90x7= LOAD						

Korak 2:

Postavite svoj tjedni plan na **grafikon volumena i intenziteta** (niski/visoki).

Označite dane u tjednu prema njihovom volumenu i intenzitetu.

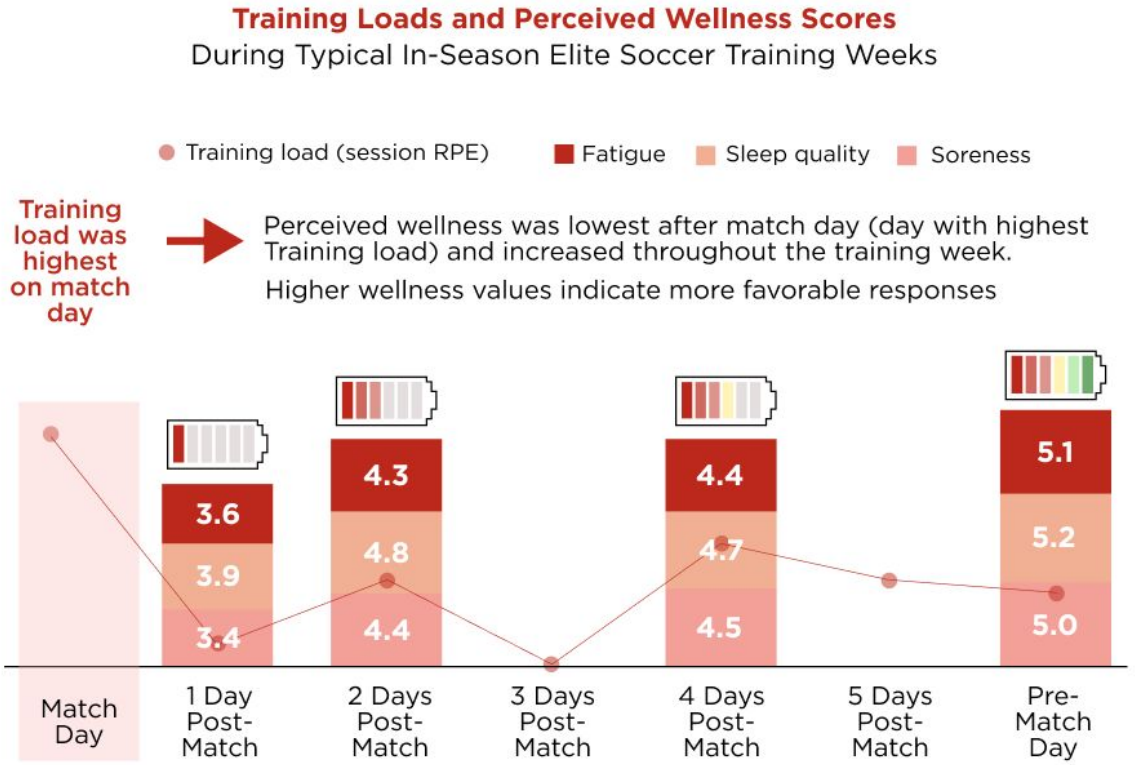


Korak 3:

Svaka grupa predstavlja svoj **mikrociklus** i objašnjava:

- Gdje bi **pojačali intenzitet**
- Gdje bi **ubacili oporavak**
- Koje bi **metrike pratili**

Koja je reakcija i jesmo li spremni za trening?



	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	

		Absolute Eccentric Hamstring Strength (N)			Relative Eccentric Hamstring Strength (N-kg 1)			Between-Limb Imbalance (%)		
Group	**Limb**	**Start of Preseason**	**End of Preseason**	**In-Season**	**Start of Preseason**	**End of Preseason**	**In-Season**	**Start of Preseason**	**End of Preseason**	**In-Season**
Injured	Injured	246 ± 79* (*n* = 27)	284 ± 77* (*n* = 17)	256 ± 157* (*n* = 2)	3.04 ± 0.97* (*n* = 27)	3.51 ± 0.95* (*n* = 17)	3.16 ± 1.93* (*n* = 2)	21.2 ± 23.8 (*n* = 27)	13.1 ± 9.6* (*n* = 17)	15.6 ± 4.9* (*n* = 2)
	Uninjured	273 ± 89 (*n* = 27)	292 ± 71* (*n* = 17)	292 ± 169* (*n* = 2)	3.37 ± 1.10* (*n* = 27)	3.60 ± 0.87* (*n* = 17)	3.61 ± 2.08* (*n* = 2)			
Uninjured	Average of left and right	301 ± 84 (*n* = 27)	330 ± 73 (*n* = 157)	323 ± 80 (*n* = 153)	3.81 ± 1.60 (*n* = 159)	4.18 ± 0.92 (*n* = 157)	4.09 ± 1.01 (*n* = 153)	18.2 ± 20.8 (*n* = 159)	10.5 ± 10.0 (*n* = 157)	10.6 ± 11.0 (*n* = 153)

Data are presented as mean ± SD. Between-limb imbalance was determined as an absolute percentage (i.e., unidirectional).
Significantly different to the uninjured group ($P < 0.005$).
Sample size from the injured group too small to make valid comparisons.

Specifically, the study found that eccentric hamstring strength below 256 N at the start of the preseason increased the risk by 2.7-fold, while a strength level below 279 N at the end of the preseason raised the risk by 4.3-fold.

Main Dashb...
Calendar
Diagnostics
Medical
Performance
Training Load
Training Pro...
Drill
Membership Fees
Admin Area

Kenny Adams
kenny.adams123@ultrax.ai
Date of birth: 01/01/1999
Age: 25
Position: Goalkeeper
Team: Team One

healthy

Manage Performance Profile

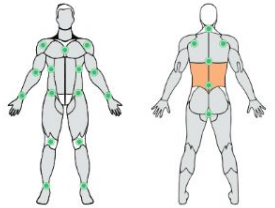
Disable next morning ITL feedback notification

Daniel Francoeur — **Performance Goal:** 3 Sep 2024
- Increase hip range of motion by 20% in all planes (flexion, extension, abduction, adduction, internal rotation, and external rotation) within the next 12 weeks.

Wellness Status

TSA

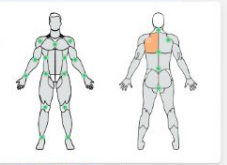
Pain Status



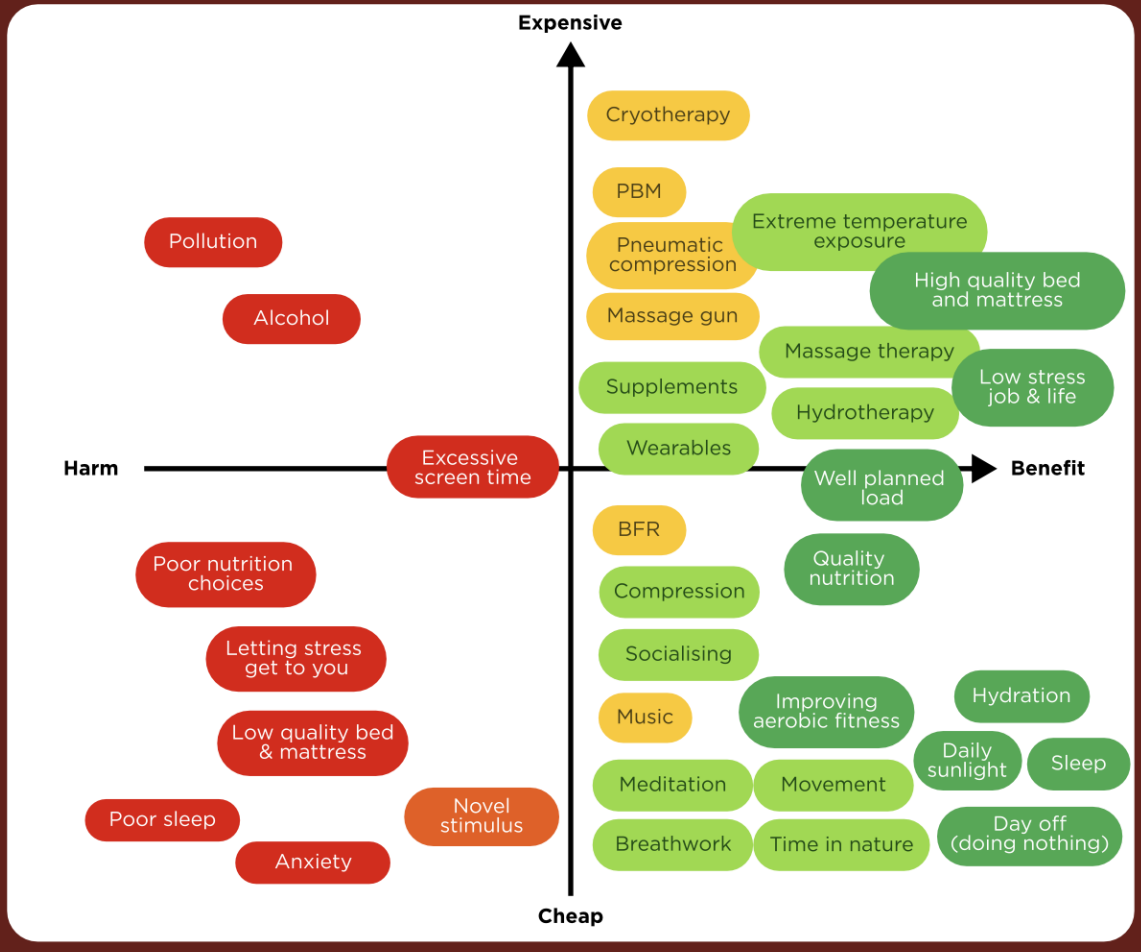
Training Load | Performance | Training Exercises | Match | KPI Alerts | Diagnostics | Medical | Media | Notes | Event Attendance

Load management

Date	ACWR	TL	DL	AL	CL	Total WL	WL Change	Freshness	Monotony	Strain	GMS	Stress	Sleep	Mood		
Oct 29, 2024 - Tue	0.86	N/A 08:00 · 60 min TG 3 · 180	180	1960	2283.62	180	+391	323.62	0	0	N/A	N/A	N/A	N/A		
Oct 28, 2024 - Mon	1.3	N/A	0	2960	2283.62	0	+391	-676.38	0	0	N/A	N/A	N/A	N/A		
Oct 27, 2024 - Sun	1.8	N/A	0	4103	2283.62	2960	+391	-1819.38	0	0	N/A	N/A	N/A	N/A		
Oct 26, 2024 - Sat	2.07	N/A	0	4619	2227.38	2960	+849	-2391.62	1.09	457.8	N/A	N/A	N/A	N/A	• Medium Pain	OK
Oct 25, 2024 - Fri	2.05	07:00 · 60 min TG 7 · 420	420	4199	2052.38	2960	+849	-2146.62	1.53	1071	5	4	2	3	• No Pain	OK
Oct 24, 2024 - Thu	1.7	06:00 · 70 min TG 10 · 700	700	3499	2052.38	2540	+849	-1446.62	0	0	N/A	N/A	N/A	N/A	• No Pain	OK
Oct 23, 2024 - Wed	1.77	N/A	0	3499	1977.38	1840	+849	-1521.62	1.66	1394.4	N/A	N/A	N/A	N/A	• Medium Pain	OK
Oct 22, 2024 - Tue	1.49	10:00 · 60 min TG 2 · 120 11:00 · 60 min TG 3 · 180 14:00 · 60 min TG 5.5 · 330 18:00 · 30 min TG 7 · 210	840	3079	2070.38	1840	+849	-1008.62	2.07	2070	4	3	4	4	• Medium Pain	Feels sick
Oct 21, 2024 - Mon	1.44	06:00 · 70 min TG 10 · 700 19:00 · 30 min TG 10 · 300 N/A	1000	2569	1784.62	1000	+849	-784.38	2.74	3131.82	N/A	N/A	N/A	N/A	• Medium Pain	OK
Oct 20, 2024 - Sun	0.86	07:59 · 127 min TG 9 · 1143	1143	1426	1655.62	2569	+849	229.62	2.02	1042.32	N/A	N/A	N/A	N/A	• High Pain	OK
Oct 19, 2024 - Sat	0.55	08:57 · 86 min TG 6 · 516	516	910	1655.62	1426	-165.5	745.62	0	0	N/A	N/A	N/A	N/A	• Medium Pain	OK
Oct 18, 2024 - Fri	0.71	N/A	0	1270	1786.88	910	-165.5	516.88	0	0	N/A	N/A	N/A	N/A	• No Pain	OK

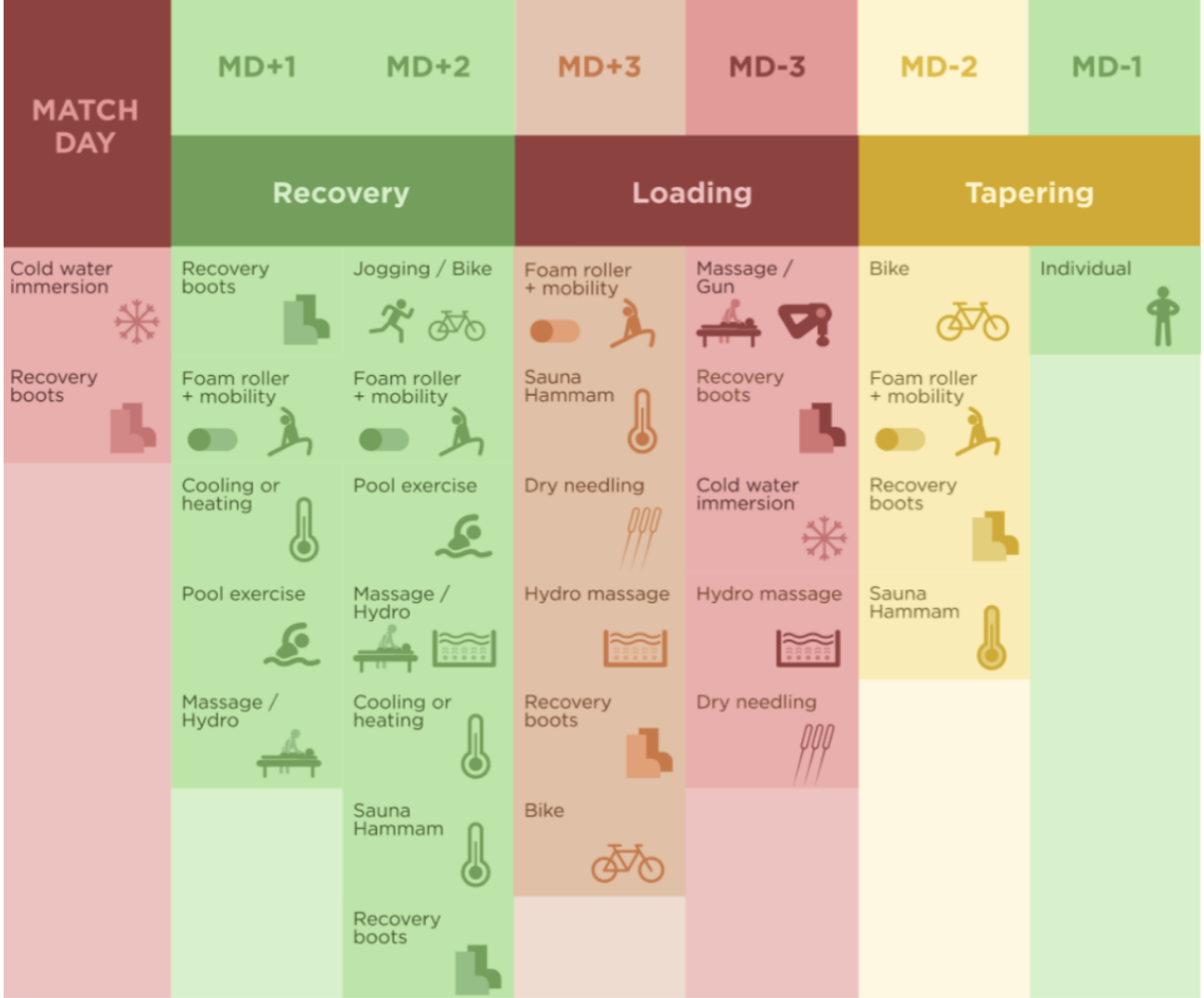


Cost-benefit
recovery quadrant



2023

marko.matusinskij@ultrax.ai


MATCH DAY
MD+1
MD+2
MD+3
MD-3
MD-2
MD-1
Recovery
Loading
Tapering
Cold water immersion
Recovery boots
Recovery boots
Foam roller + mobility
Cooling or heating
Pool exercise
Massage / Hydro
Jogging / Bike
Foam roller + mobility
Pool exercise
Massage / Hydro
Cooling or heating
Sauna Hammam
Recovery boots
Foam roller + mobility
Sauna Hammam
Dry needling
Hydro massage
Recovery boots
Bike
Massage / Gun
Recovery boots
Cold water immersion
Hydro massage
Dry needling
Bike
Foam roller + mobility
Recovery boots
Sauna Hammam
Individual

Recently, researchers have attempted to quantify and study different periodization models from elite teams (Malone et al, 2015; Martin-Garcia et al, 2018), however, it is not ideal for coaches to adapt plans and training models from elite teams, as elite players' characteristics are not the same

Periodization of recovery plays a crucial role in keeping your players fresh and ready to perform.

- Best Practice and tradition
- Scientific literature
- Opinion of the wisdom
- Heuristics
- Current state
- Intuition and preferences
- Objectives
- Previous experimentation
- Barbell Strategy
- Randomization
- Robust
- Is-ought - experiment

ULTRAX

Marko Matušinskij
marko.matusinskij@ultrax.ai
+385 91 150 8277

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