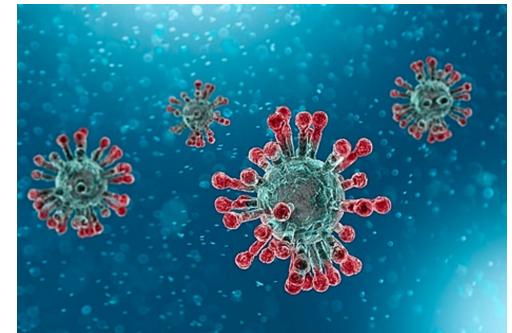


Messi



Why and why now ?

- ICU workforce
 - High daily work load
 - Ethical challenges
 - High patient mortality and morbidity
 - Long working hours
- Currently renewed interest about psychosocial effects of working in ICU
- Occupational safety- Mistakes, Patient safety



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PICS-SG Research Priority List

2020

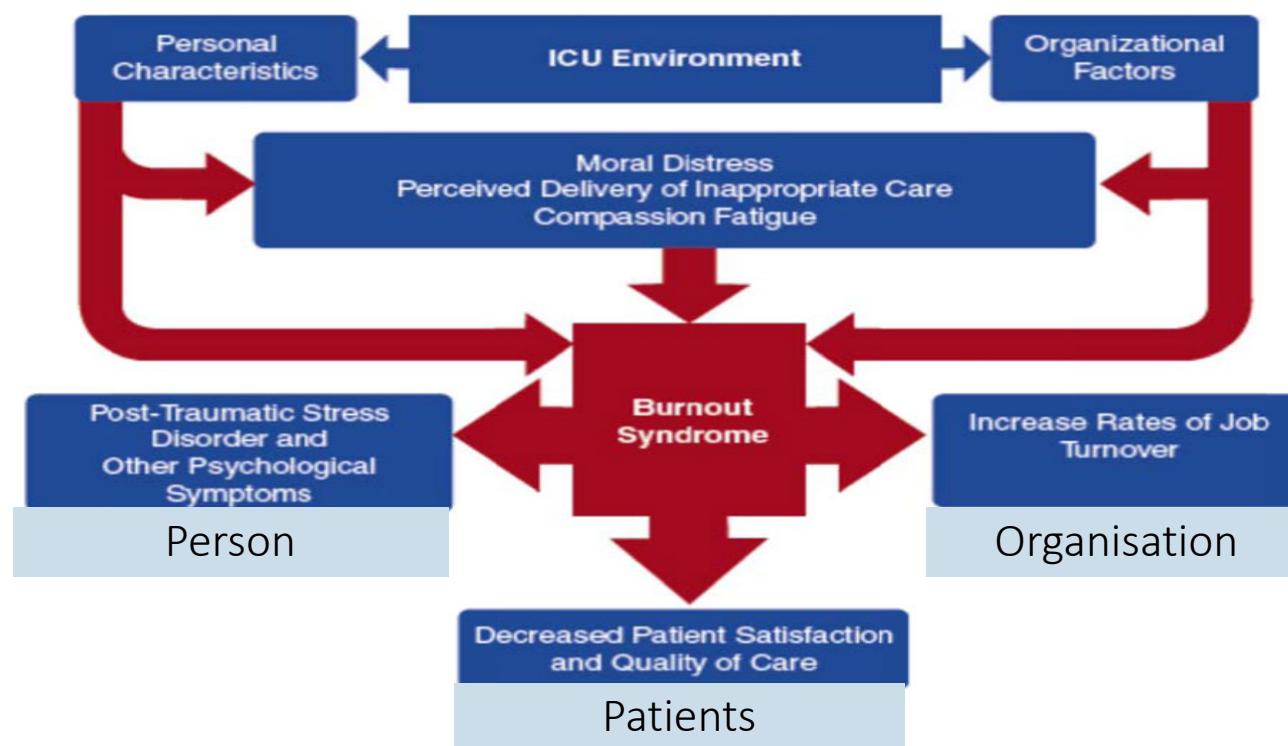
Where are the 'gaps'?		National
1	End of Life: What are parents' experiences of conversations about life limitation?	X
2	Staff wellbeing: In PICU staff, would targeted interventions to reduce staff distress, compared to nothing, impact on Post-Traumatic Stress Disorder (PTSD), burnout, retention rates and moral distress?	X
3	Staff retention: In PICU staff, do targeted interventions to retain staff working in PICU, compare to standard practice, impact on staff retention rates	X
4	Rapid pathogen identification: In PICU children on antibiotics for >48hours for suspected infection, does rapid pathogen identification and antibiotic rationalisation, compared standard practice, reduce the prevalence of antibiotic resistance and improve cost-effectiveness?	INHALE THE A STOP STUDY
5	CYP Outcomes What are the short and longer-term physical, cognitive, functional and psychosocial outcomes of children after critical illness?	OCEANIC
6	Staffing ratios: In ventilated children on PICU with single organ failure, does 1:2 RN:patient ratio, compared to standard 1:1 ratio, impact on adverse events, costs and length of ventilation?	Adult ICU SEISMIC



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AFFECTS PHYSICIAN PERFORMANCE



Rule
of
3

3 Reasons, 3 Effects, 3 Casualties



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What is already known

- Qualitative studies / Surveys

Approx. 47% of ICU physicians affected (Embriaco, et al. Am J Respir Crit Care Med. 2007;175:686–92.

- Identifies Psychological aspects
 - Perceived stress scale
 - Maslach burnout inventory
 - Hospital anxiety and depression scale
- Identifies some risk factors
 - Sex
 - Whether on service or not
 - Role : Nurses vs physicians
 - Age : young vs old



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Unknowns and proposal

- No quantitative assessment of stress and effects on physician performance
- ICU akin to performance field sports e.g Football
- Measuring/monitoring athlete (physician) performance
- Quantitative/Semi Quantitative assessment of Stress
- Using wearable technology/non invasive monitoring
 - Physiological status
 - Simple biochemical reactions (e.g glycolysis)
 - Signalling molecules (e.g cortisol)



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EIS,FA,ECB : How they do it !

External Load

- Step count



Internal (Training) Load

- HRV (J. Naranjo Orellana *et al.*): Work load activity acuity and stress
- A. <https://doi.org/10.1161/01.CIR.93.5.1043>- Circulation
- Physiological HR Mismatch



Response

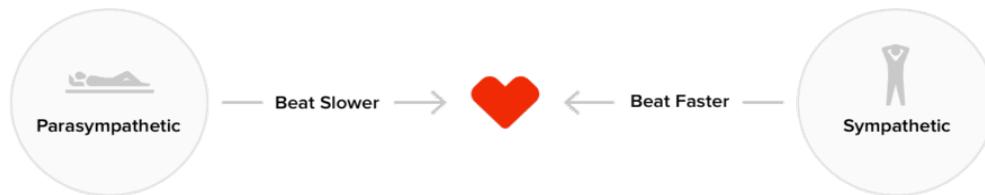
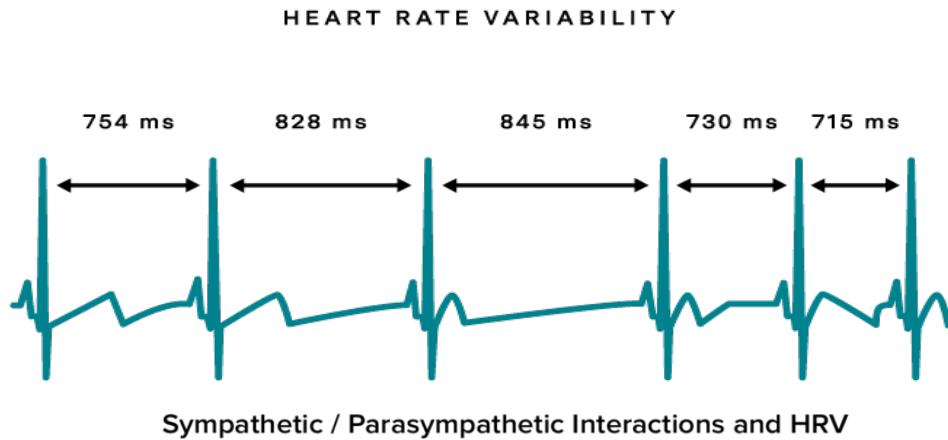
- Sleep Quality: Pre match day , On and Post Match day
 - Regular questionnaire/Sleep diary
- Salivary/Ear wax cortisol ? – Not favourable
 - Effectiveness of an intervention (phase 2)



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Internal load: HRV



- One of the best objective metrics for physical fitness and determining body's readiness to perform.
- Measuring the period between heart beats (know as the Inter Beat Interval or IBI) over long periods,

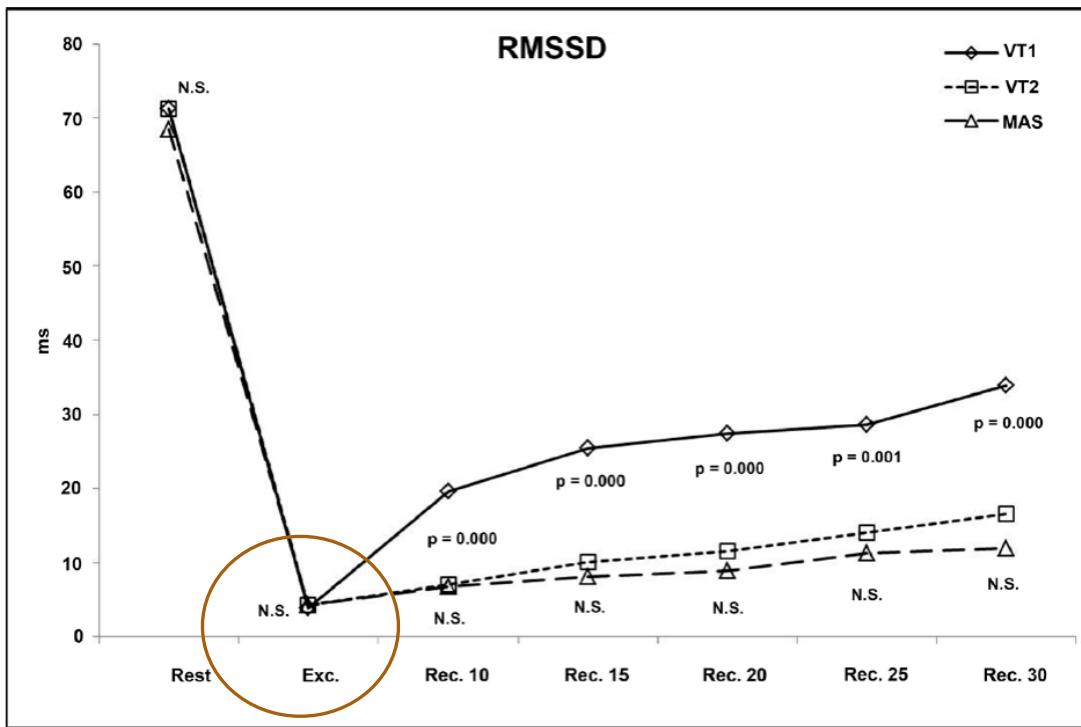
Relationship- HRV and Stress

- High HRV : Adequate balance
 - Best performance ability
 - Athletes have high HRV
- Low HRV : One system (normally sympathetic) dominates.
 - Indicates Stress, Fatigue and need to recover
- Trends measurements are important.
- Even used by the army for PTSD

(Tan, G., *et al. Appl Psychophysiol Biofeedback* <https://doi.org/10.1007/s10484-010-9141-y>)

- Age and Sex normograms available

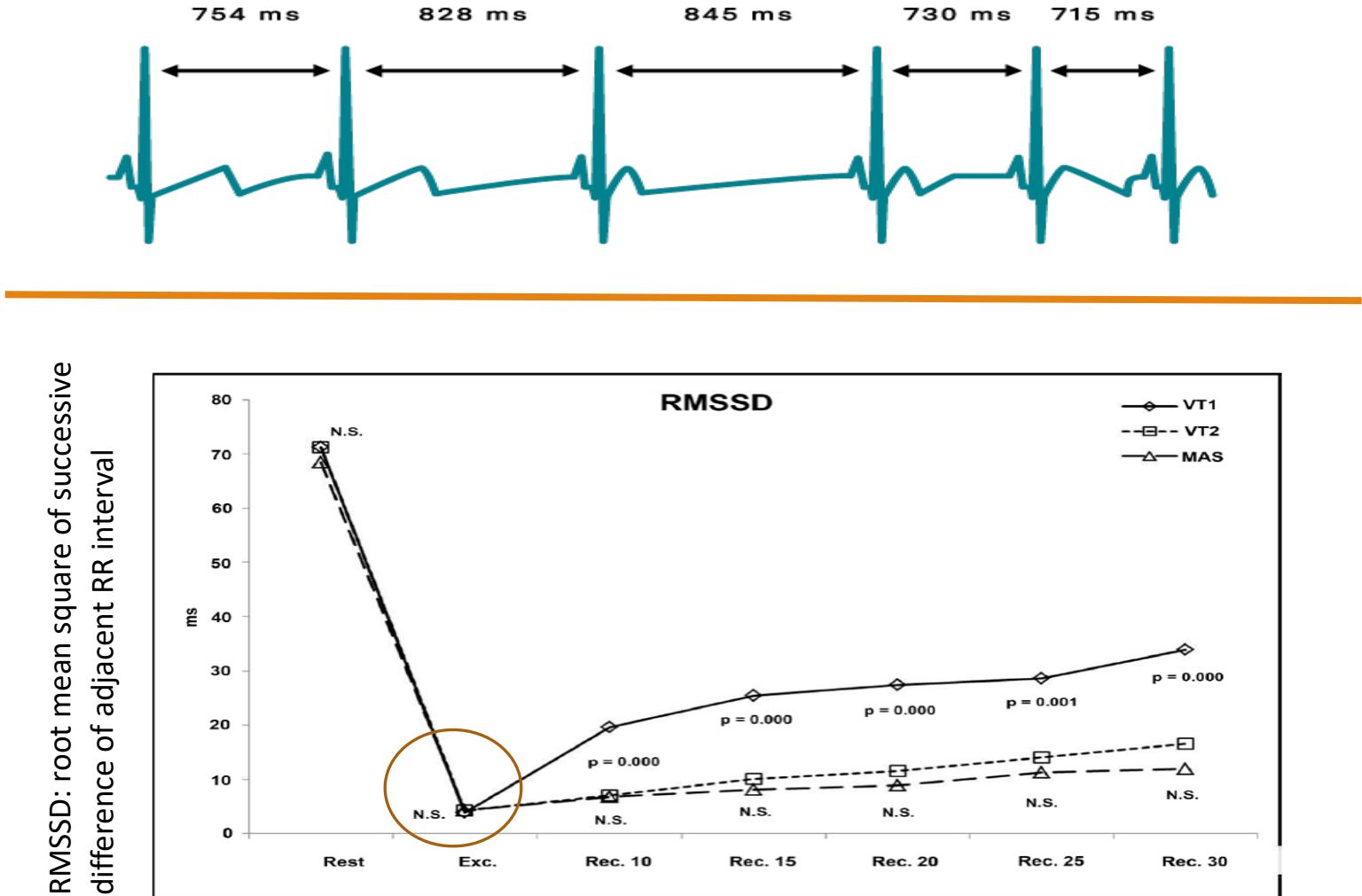
RMSSD: root mean square of successive difference
Of adjacent RR interval



The greater the recovery slope, the less the internal load. J. Naranjo Orellana *et al.* Health, 11, 211-221.

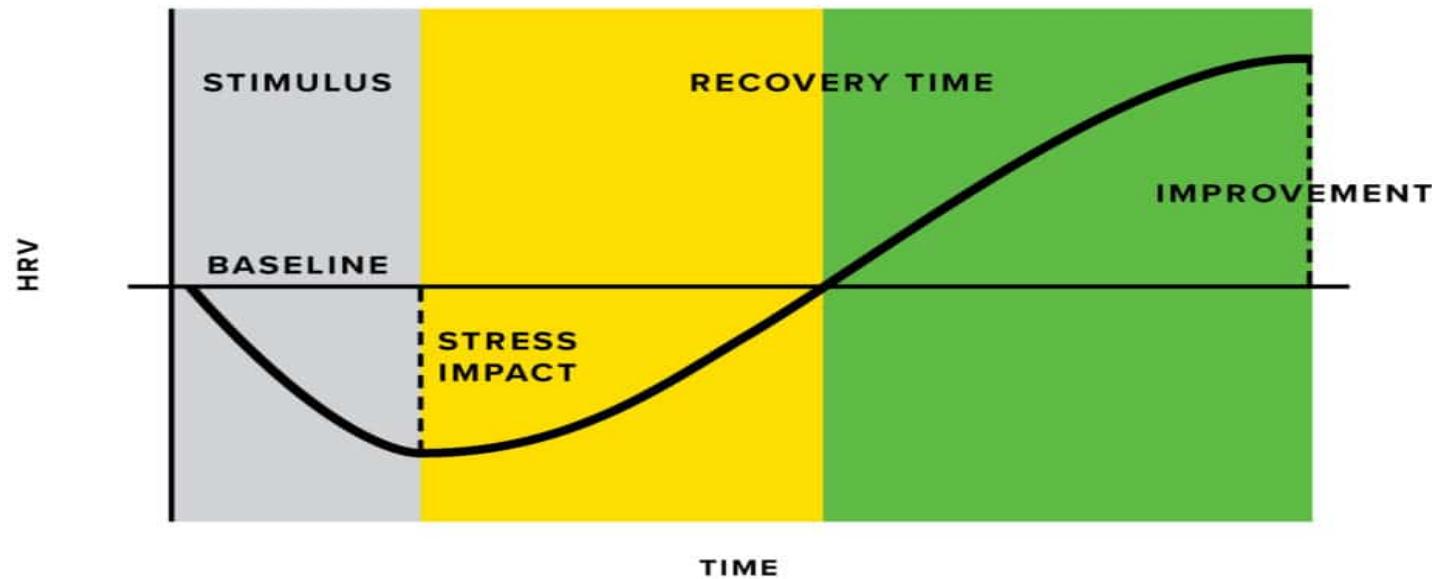
<https://doi.org/10.4236/health.2019.112019>

HEART RATE VARIABILITY



The greater the recovery slope, the less the internal load. J. Naranjo Orellana *et al.* Health, 11, 211-221. <https://doi.org/10.4236/health.2019.112019>

TRAINING ADAPTATION



Response: Sleep quality

Gold standard: Polysomnography

Actigraphy: validated against polysomnography

doi: [10.1111/j.1365-2869.2011.00917.x](https://doi.org/10.1111/j.1365-2869.2011.00917.x)

Used in athletes

doi: [10.1080/02640414.2012.660188](https://doi.org/10.1080/02640414.2012.660188)

Sleep

Sleep quality: sleep efficiency, fragmentation index , sleep latency/time awake

Exposure to light

Activity during sleep

What is the Gold Standard

Sleep diary (American association of sleep disorder/ British)



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Motion watch 8

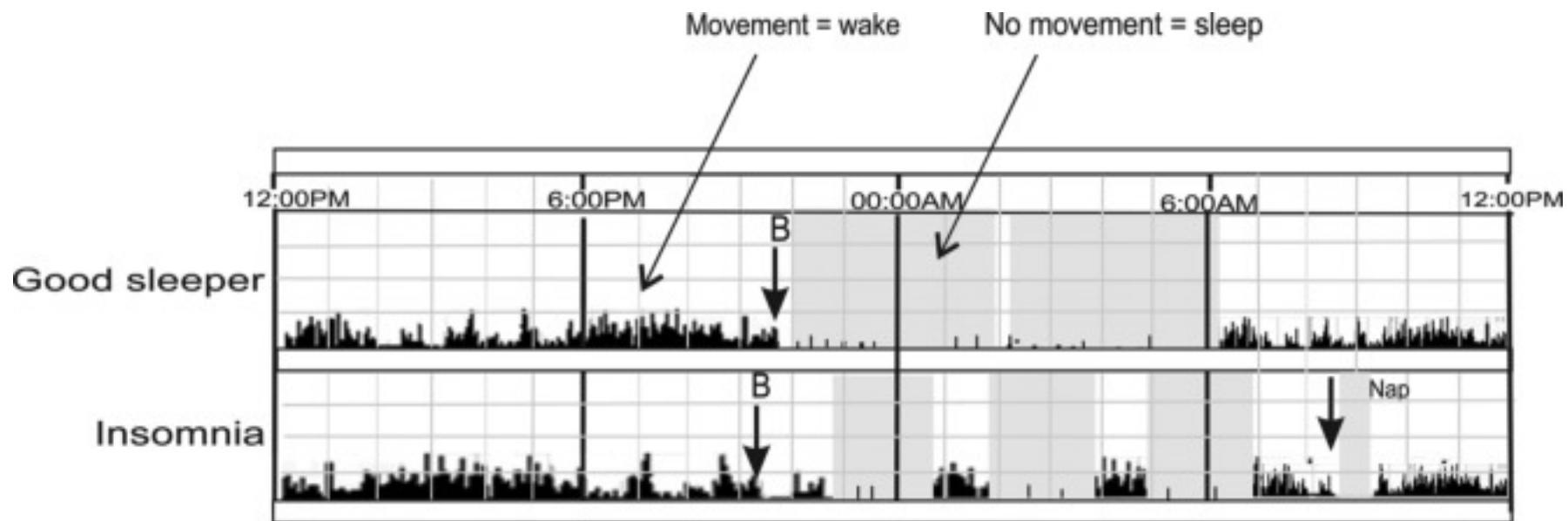
Next generation of tri-axial actigraphy

- Sleep , Circadian rhythm, Physical activity, Light data
- 9g, Bath and Swim
- Price approx. £600/watch



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Actigraphy-Insomnia



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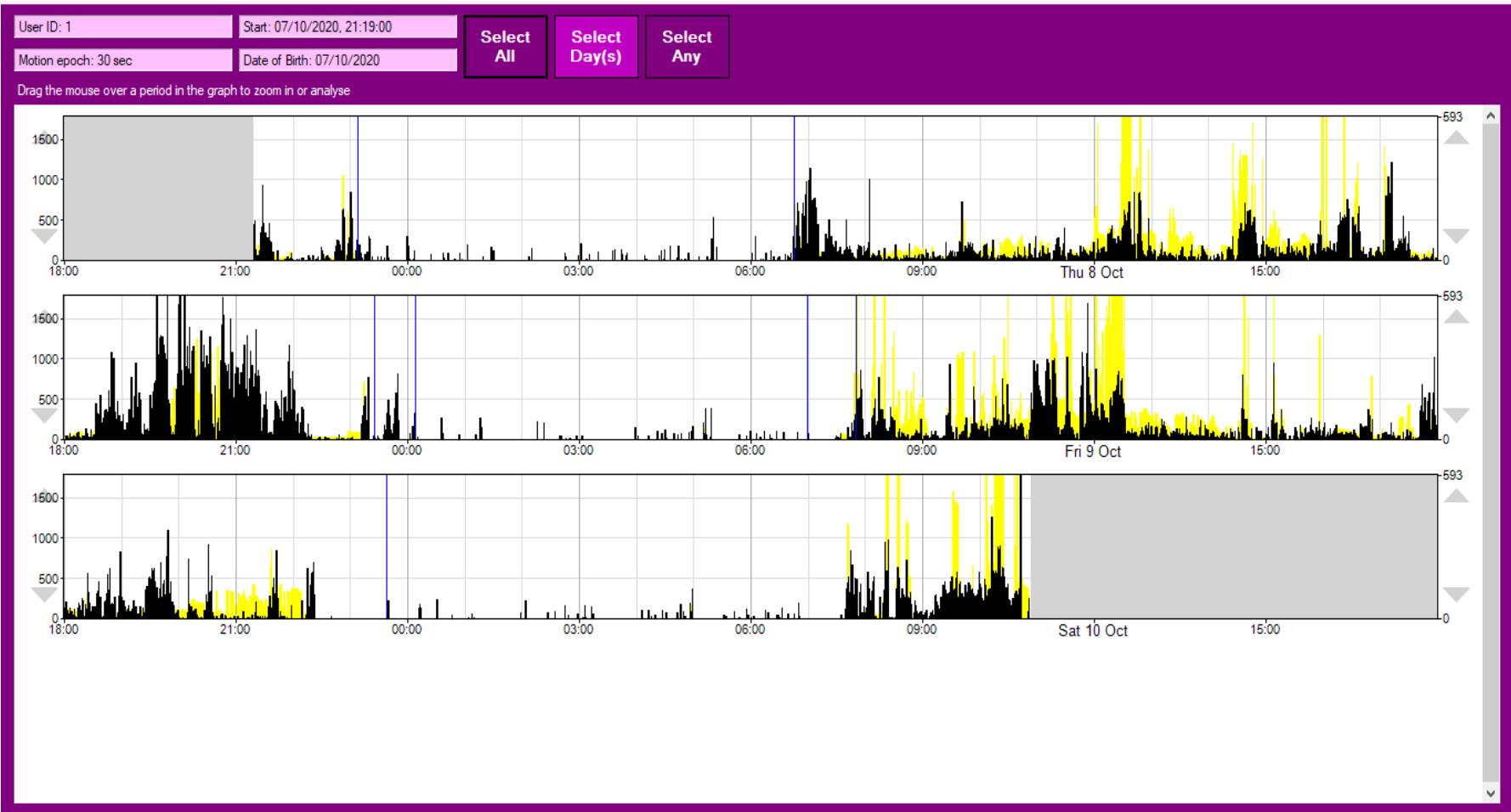
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Data 1

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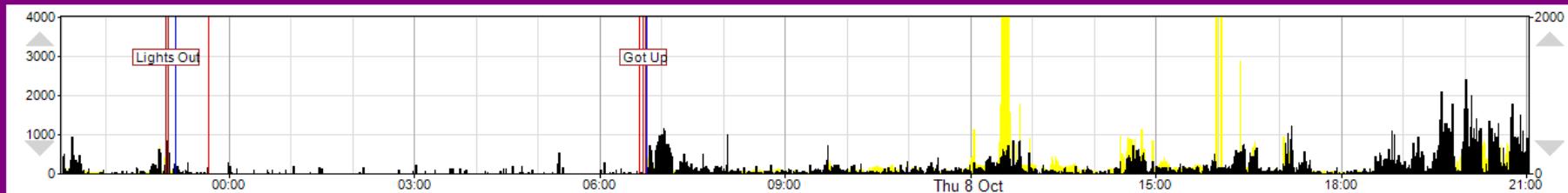
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[Print Preview](#)[Print...](#)

Analysis Function:

- 123 Summary
- Sleep**
- NPCRA
- 24h Average
- Edit
- Napping

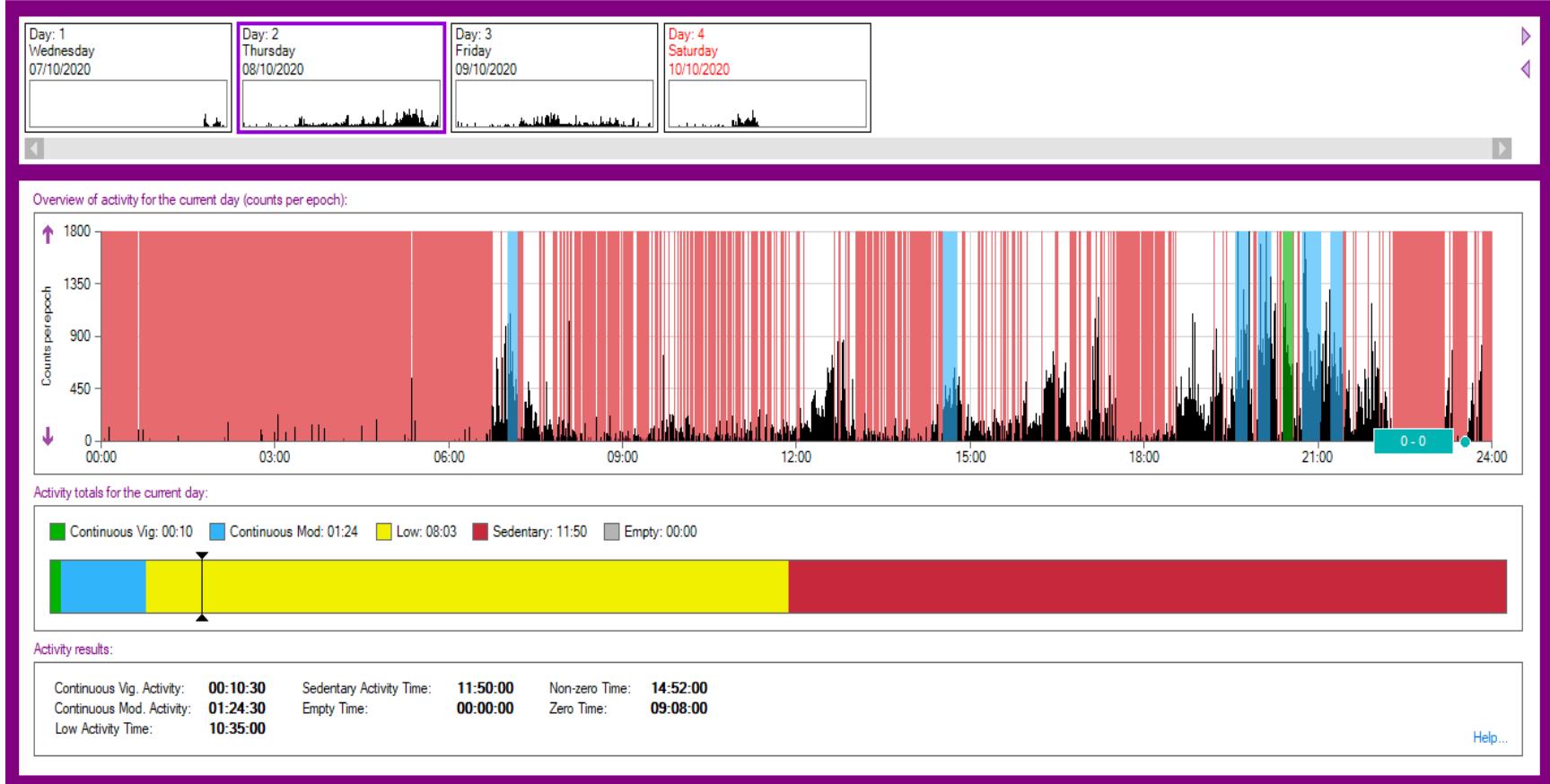
Lights out	23:00	Got up	06:43
Fell asleep	23:39	Woke up	06:38
Time in bed	07:43	Assumed sleep	06:58
Actual sleep time	05:39	Actual sleep (%)	81.0
Actual wake time	01:19	Actual wake (%)	19.0
Sleep efficiency (%)	73.2	Sleep latency	00:39
Sleep bouts	45	Wake bouts	46
Mean sleep bout	00:07:32	Mean wake bout	00:01:44
Immobile mins	380	Immobile time (%)	90.8
Mobile mins	38.5	Mobile time (%)	9.2
Immobile bouts	59	Mean immobile bout	00:06:26
Immobile bouts <=1min	13	Immobile bouts <=1min (%)	22.0
Total activity score	6435	Mean activity /epoch	7.69
Mean nonzero activity /epoch	83.57	Fragmentation Index	31.2
Threshold	20.0	Rest per 24h (%)	46.9
Average light (lux)	0.25	Central Phase Measure (min)	188.8

[△ Options](#)[△ Copy Results](#)[Save Sleep Period](#)HEART AND LUNG**NHS**

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Day Analysis - User ID: 1

File View Tools Report



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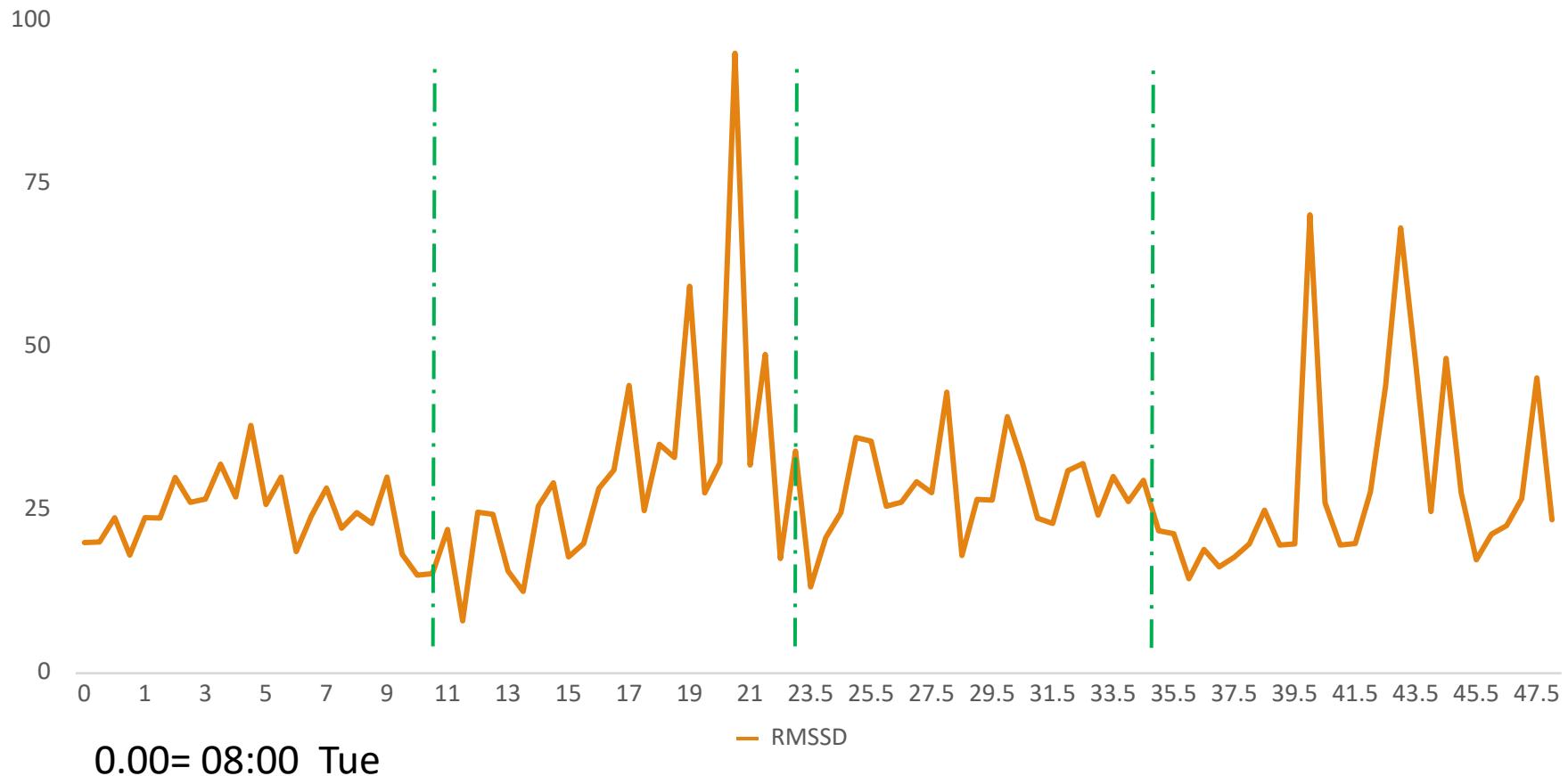
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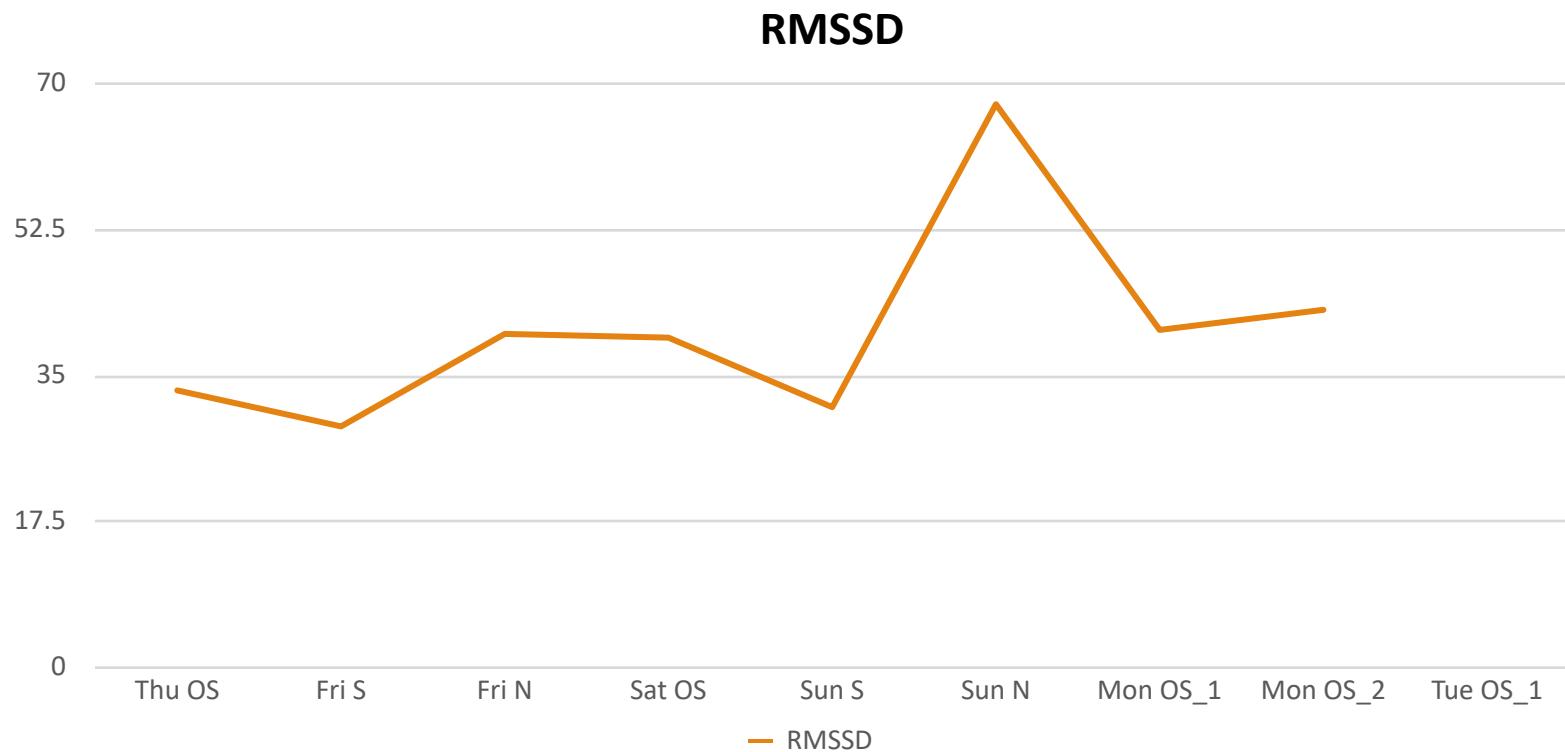
RMSSD- Rohit Tue HF shift



HF shift Tue/Wed



4 day cycle of shifts



Data 2

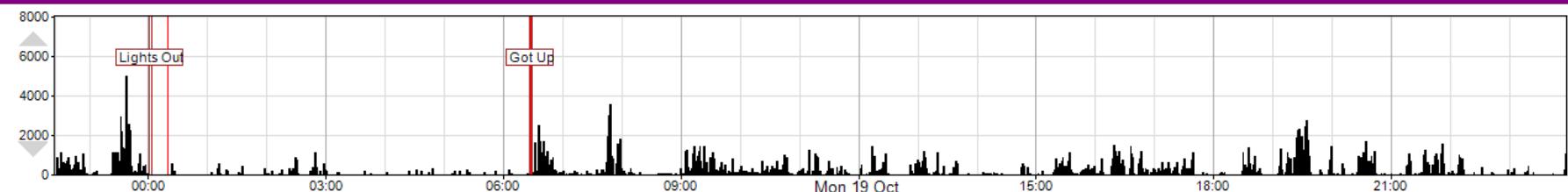
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Print Preview

Print...



Analysis Function:

- 123 Summary
- Sleep
- NPCRA
- 24h Average
- Edit
- Napping

Sleep Analysis	
Lights out	00:02
Fell asleep	00:20
Got up	06:27
Woke up	06:27
Time in bed	06:25
Actual sleep time	04:03
Actual wake time	02:04
Sleep efficiency (%)	63.1
Sleep bouts	30
Mean sleep bout	00:08:06
Immobile mins	296
Mobile mins	71
Immobile bouts	46
Immobile bouts <=1min	14
Total activity score	13937
Mean nonzero activity /epoch	196.30
Threshold	20.0
Central Phase Measure (min)	203.5
Assumed sleep	06:07
Actual sleep (%)	66.2
Actual wake (%)	33.8
Sleep latency	00:18
Wake bouts	29
Mean wake bout	00:04:17
Immobile time (%)	80.7
Mobile time (%)	19.3
Mean immobile bout	00:06:26
Immobile bouts <=1min (%)	30.4
Mean activity /epoch	37.98
Fragmentation Index	49.8
Rest per 24h (%)	39.7

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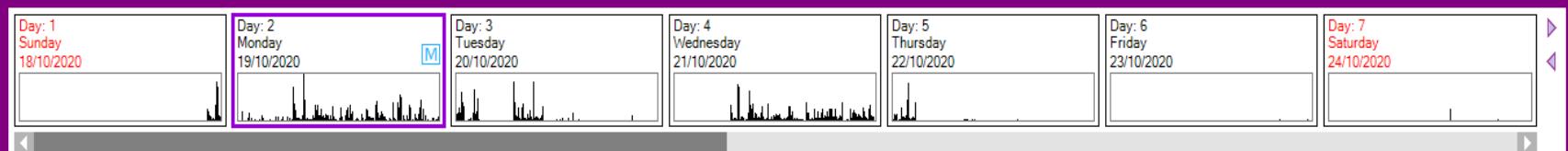


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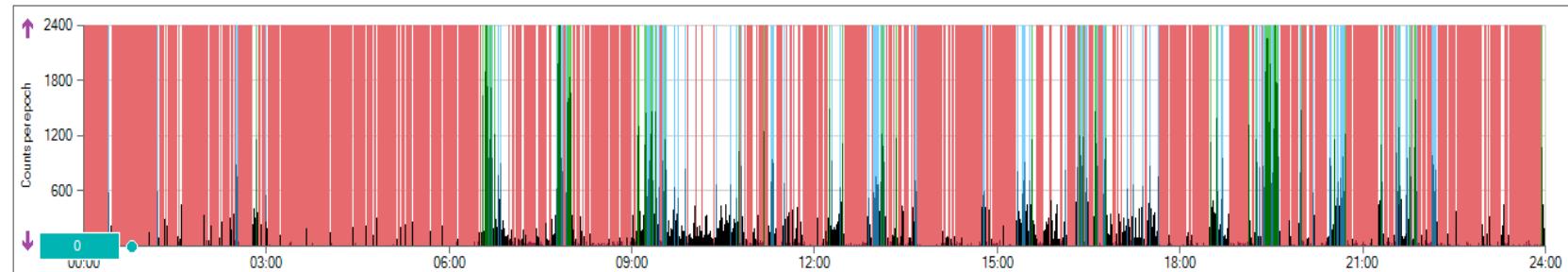
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Day Analysis - User ID: cho

File View Tools Report



Overview of activity for the current day (counts per epoch):



Activity totals for the current day:

■ Vigorous: 01:06 ■ Moderate: 01:43 ■ Low: 06:35 ■ Sedentary: 14:36 ■ Empty: 00:00



Activity results:

Vigorous Activity Time:	01:06:00	Sedentary Activity Time:	14:36:00	Non-zero Time:	13:59:00
Moderate Activity Time:	01:43:00	Empty Time:	00:00:00	Zero Time:	10:01:00
Low Activity Time:	06:35:00				

[Help...](#)

Calibration (CPM): [Change](#)

Recording Mode:

Trivial



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Daily Sleep Diary

Complete the diary each morning ("Day 1" will be your first morning). Don't worry too much about giving exact answers, an estimate will do.

Your Name _____

The date of Day 1 _____

	Enter the Weekday (Mon, Tues, Wed, etc.)	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1	At what time did you go to bed last night?							
2	After settling down, how long did it take you to fall asleep?							
3	After falling asleep, about how many times did you wake up in the night?							
4	After falling asleep, for how long were you awake during the night <u>in total</u> ?							
5	At what time did you finally wake up?							
6	At what time did you get up?							
7	How long did you spend in bed last night (from first getting in, to finally getting up)?							
8	How would you rate the <u>quality</u> of your sleep last night? 1 2 3 4 5 V. Poor V. Good							

Can be done in electronic format?



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Proposal strengths

- Novel semi-quantitative assessment for ICU setting
- Validated non invasive tools
- Wearable technology in vogue
- Tested by highest elite performers : Olympic athletes and Army
- Strategically aims to covers national gap
- Fits the current COVID-19 theme
- Not just multidisciplinary but truly inter-organisational