Beyond Basics: Advanced Pacing and Heart Rate Monitoring in ME/CFS

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Industry Adjunct, Adelaide University
Specialising in ME/CFS, POTS, EDS/HSD and other “invisible illnesses”

Background

My role as an Exercise Physiologist is quite varied:

- Pacing and energy management for fatigue, electrolyte and fluid optimisation, compression garments and pain management
- Real time monitoring of heart rate and heart rate variability to help during daily tasks or structured movement
- Heart rate variability education and guidance
- Developing a movement plan (where appropriate) to improve ability to safely complete functional tasks and engage in activities with ME/CFS, dysautonomia and/or hypermobility
- Vagus nerve stimulation guidance, including tVNS and breathwork through biofeedback

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Overview & learning outcomes

- Review pacing for ME/CFS in the context of post-exertional malaise (PEM) and allostatic load
- Understand the complexities of calculating a heart rate threshold for pacing
- Describe heart rate variability (HRV)
- Discuss HRV in the context of ME/CFS
- Identify different strategies to introduce heart rate and HRV into pacing for ME/CFS
- Q&A

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Defining fatigue and post-exertional malaise

Chronic fatigue is not the same as ME/CFS

- Many diseases and circumstances present with chronic fatigue including:
  - Thyroid conditions, deconditioning, autoimmune disease, cancer, mental health conditions.
- Fatigue does not tell us about cause, severity, chronicity or impact on function.
- Profound fatigue is one symptom of ME/CFS:
  - **Post-exertional malaise is specific to ME/CFS**
- Critical distinction to avoid inappropriate treatment and management - or missing another condition.

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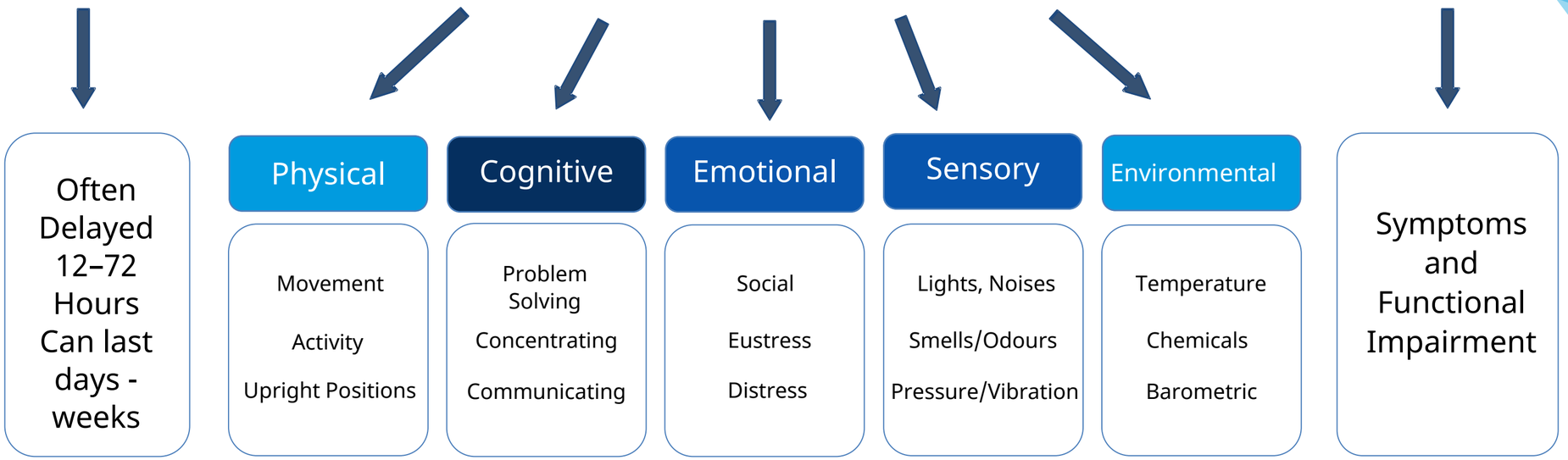
Post Exertional Malaise



Ordinary daily activities such as showering, attending a medical appointment, a phone conversation, being in a bright room or reading can trigger PEM

What is PEM?

Pathological, systemic failure of energy production that results in profound worsening of, and often new, symptoms following exertion.

PEM is not:

- Second day muscle soreness
- Being more tired than usual after normal levels of activity
- Fatigue
- Deconditioning
- Relieved by normal amounts of rest

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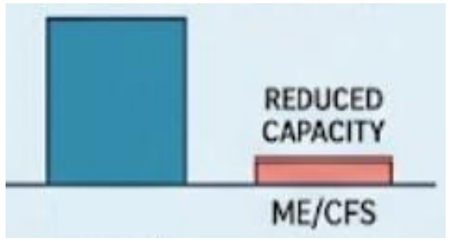
Adapted from Clayton Powers and National Academy of Medicine, 2015

Energy management recap

Pacing

Involves breaking tasks into smaller, manageable parts, spreading them out over time, and alternating between periods of activity and rest.

- Goal = stay within “energy envelope” – amount of energy someone has available.
- Prevents pushing beyond limits, often resulting in PEM.
- Aiming to take breaks <u>before</u> over-exertion.



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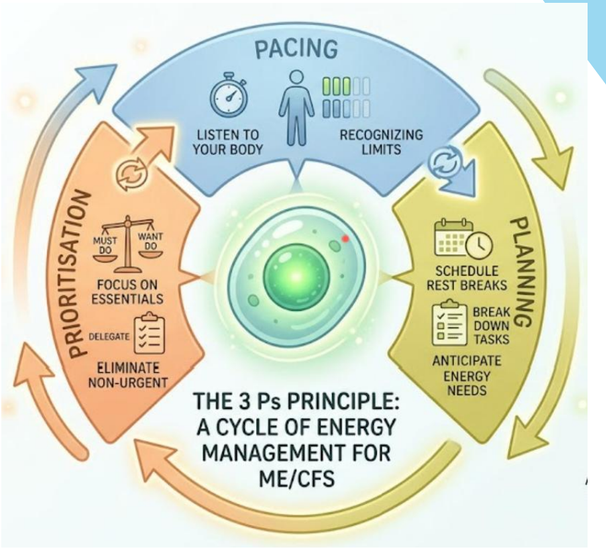
Antcliff et al 2019

Prioritisation and planning

Pacing requires prioritising activities based on their:

- Importance and urgency
- Focusing on what is essential
- Incorporating realistic goals



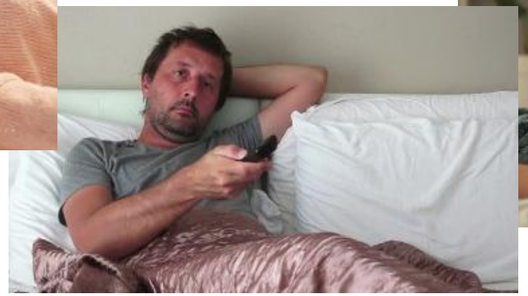
- Planning involves **allocating time for rest and activities**, taking into account the fluctuating nature of energy levels in ME/CFS.

Antcliff et al 2019

Resting strategically

Effective pacing includes incorporating both scheduled and as-needed rest periods.

- Rest isn't solely about sleeping, for some people it can also mean engaging in very low-energy activities that allow for recovery.



Antcliff et al 2019

Heart rate monitoring to assist pacing

Where does HR monitoring fit in to ME management?

- Mayo Clinic 2023 review of management for ME/CFS discusses to assist with PEM:
  - **Pacing**/rest, stimulus reduction, **tracking devices or diaries** for symptoms.

- Current NICE Guidelines for ME/CFS state:
  - 1.11.4: Establish an individual activity pattern within **current energy limits** that minimises symptoms.
  - 1.11.7: Make **self-monitoring of activity** as easy as possible by taking advantage of any tools the person already uses, such as an **activity tracker, phone heart rate monitor or diary**.

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Grach 2023; NICE 2021

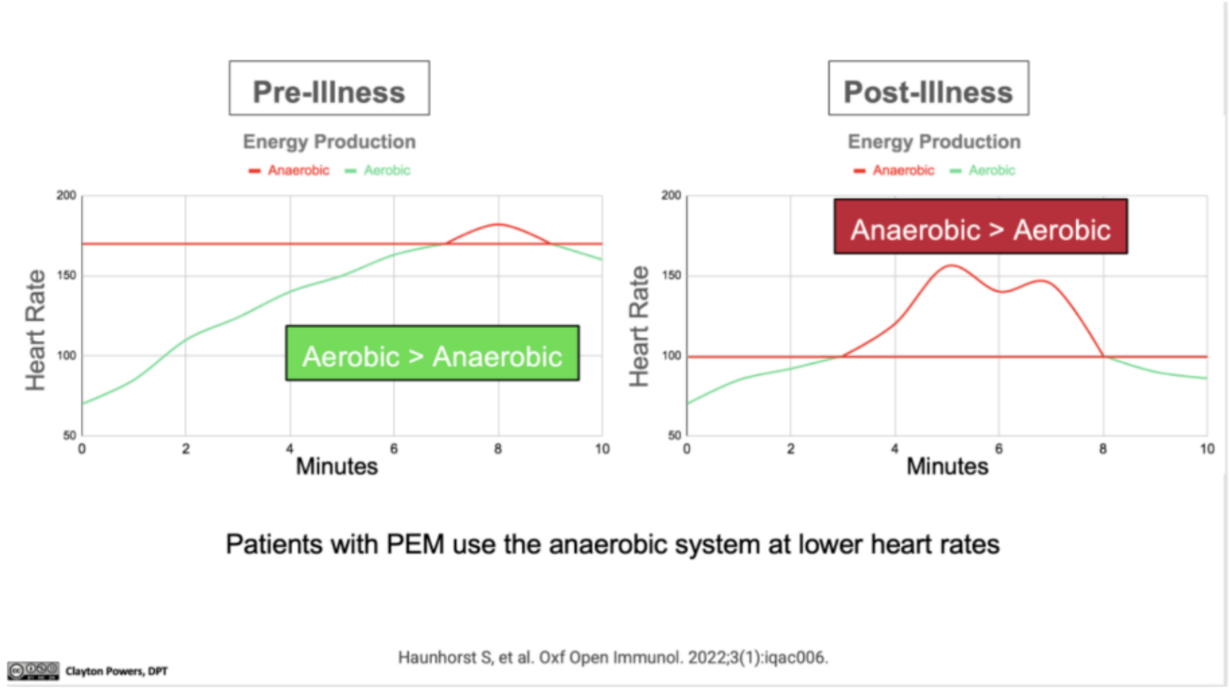
The complexities of HR pacing

Goal of pacing using a heart rate monitor (HRM) is to reduce frequency and severity of PEM.

- ME/CFS = impaired oxygen extraction
- Physical exertion that keeps the heart rate (HR) below the anaerobic threshold (AT) can help prevent PEM

Direct relation between HR and AT, several calculations have been proposed - most common being:

- 55% HRmax
- Resting HR +15bpm
- Van Campen et al 2020



Davenport et al 2010; Van Campen et al 2020; Workwell Foundation 2025

Activity – HR pacing calculation

1. 55% of 220 – age = HR pacing threshold

2. Resting HR + 15bpm = HR pacing threshold

Additional info:

- Age of the person = 30 years old
- Resting HR from their watch = 75bpm

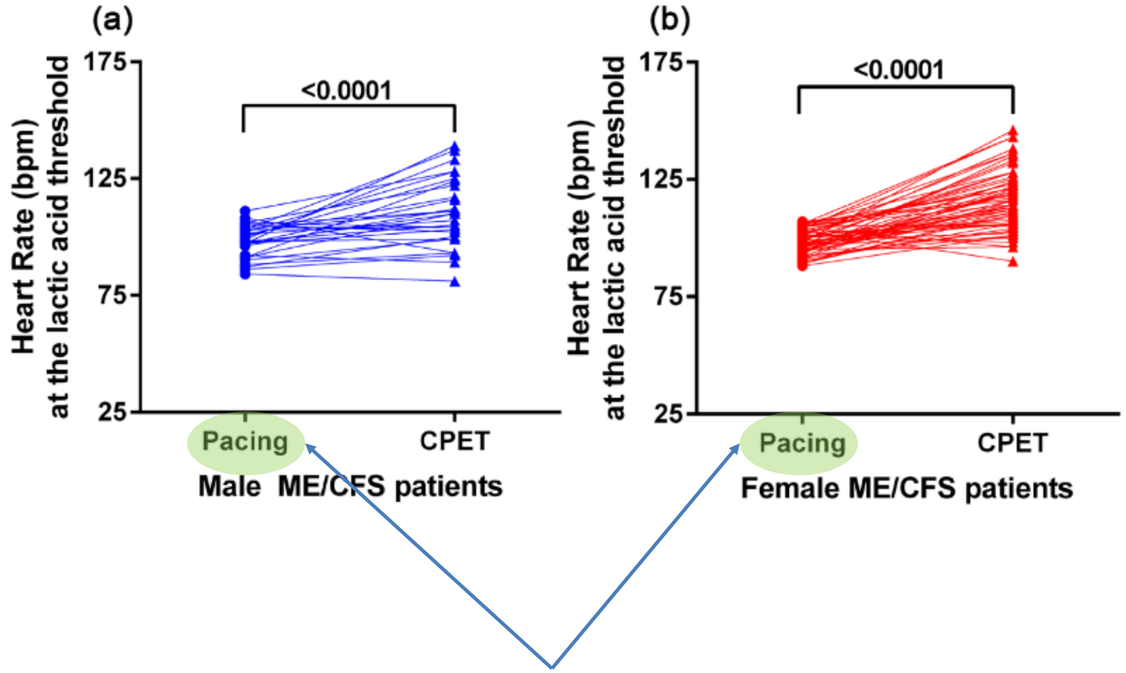
Activity – HR pacing calculation

1. 55% of 220 – age = HR pacing threshold
   - 220 - 30 x 55% = ~105bpm
2. Resting HR + 15bpm = HR pacing threshold
   - 75 + 15 = 90bpm

Difference between the 2 calculations = 15bpm

HR pacing

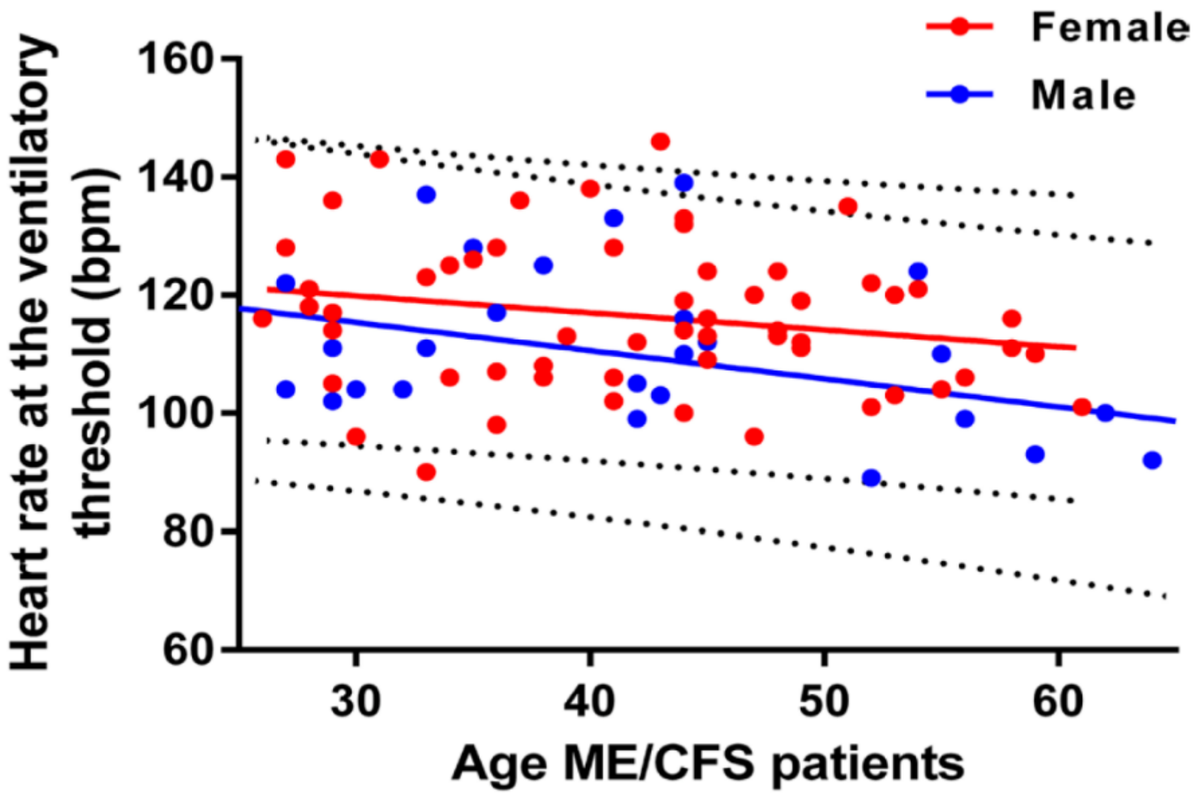
- Van Campen et al 2020 study



Van Campen et al 2020

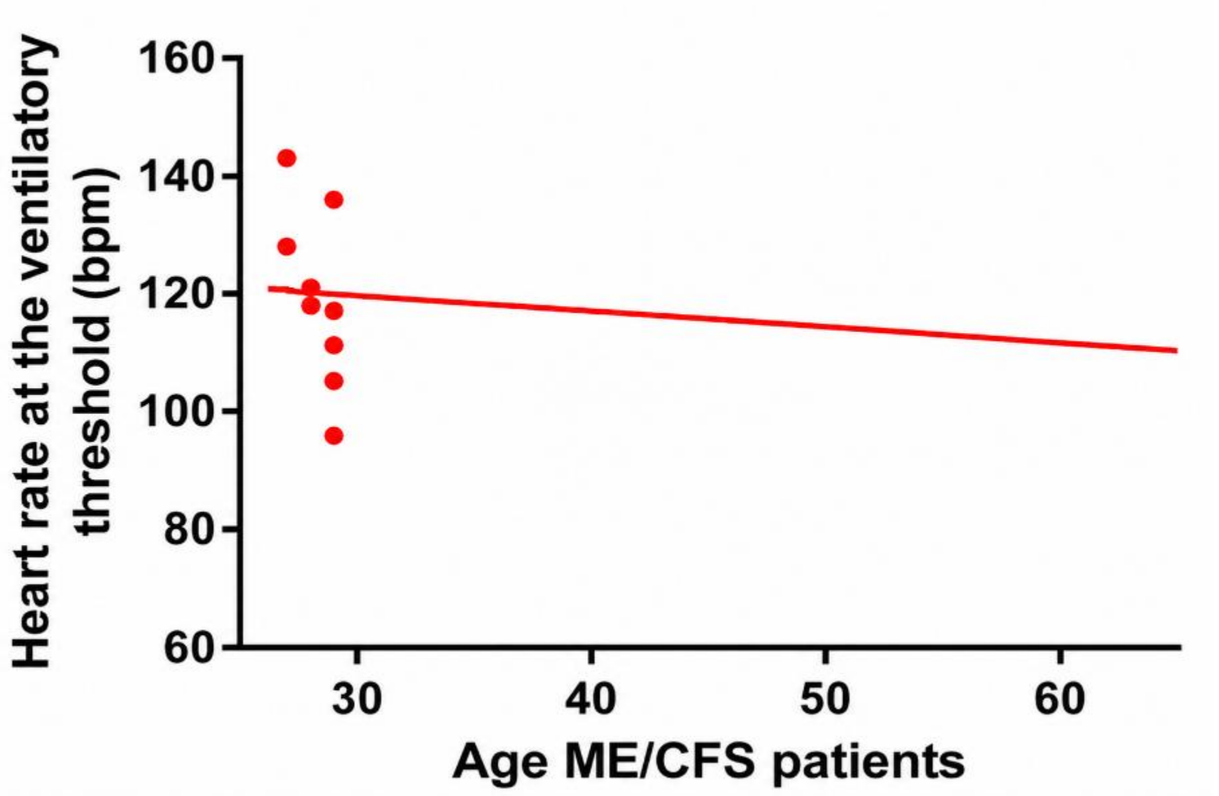
HR pacing

- It’s <u>complex</u> and it will often need closely guided adjustment



Van Campen et al 2020

HR pacing



Adapted from Van Campen et al 2020

Clinical application

- **Starting point** often impacted by the **level of someone's Orthostatic Intolerance**
  - Eg if POTS or strong autonomic dysfunction profile with their ME/CFS
- **Bracket by 5bpm as required** (or less if preferred)
  - Only increase if you are certain tolerating current HR threshold
  - Can decrease **at any time** if HR threshold suspected to be too high
  - **Aim is <u>not</u> to change as a "progression", but to more appropriately represent their AT**
- **Minimise time >HR threshold** – up to 2min max at a time
  - Some people may only tolerate a few seconds above threshold at a time

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Clinical application – example

1. 🔍 **Clinical presentation and watch data**

- **Substantial OI:** The person's heart rate (HR) spikes and is sustained at **>90 bpm** even when seated.
- **Upright activity:** HR rises and is mostly **>100 bpm** when standing or moving around upright.
- **Validating data:** These HR patterns are validated by smart watch data.
- **Standard formula limitations:** It is likely that the standard formula of **Resting Heart Rate (RHR) + 15 bpm** will be far too low for this person.

2. 💬 **Subjective Assessment**

- **Tolerable range:** The patient is capable of coping with a heart rate up to **110 bpm**.
- **Symptom onset:** The patient reports that they **"always feel it"** once their HR exceeds **115 bpm**.

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Clinical application – example

3. 🎯 Initial plan

- **Suitable HR starting threshold:** The initial starting threshold should likely be set between **105-110 bpm**.
- **Initial starting point, not fixed:** this is an initial starting point, **not** an exact, "set and forget" limit.
- **Flexible adjustment:** The plan should include the view to adjust this threshold as required.
- **Time above threshold cap:** Further discussion about duration of HR above threshold before resting (eg. an absolute maximum of **2 minutes**).

Heart rate variability to assist pacing

What is heart rate variability?

- Not to be confused with “delta HR”. Heart rate variability (HRV) is beat to beat HR change.
- Unlike HR, which measures the average number of heart beats per minute, HRV focuses on the tiny, moment to moment changes in the time between each heart beat.
  - Note, both time and amplitude domains vary between each heart beat.

Why is there variability?

- Variability in heart rate is the result of the body adapting to something. Our body continuously adjusts to maintain a state of balance (allostasis).

💡 **The Analogy:** If *allostasis* is your car accelerating and braking to navigate a bumpy road, *allostatic load* is the wear and tear on the tires and brakes after months of driving on that rough terrain without a service

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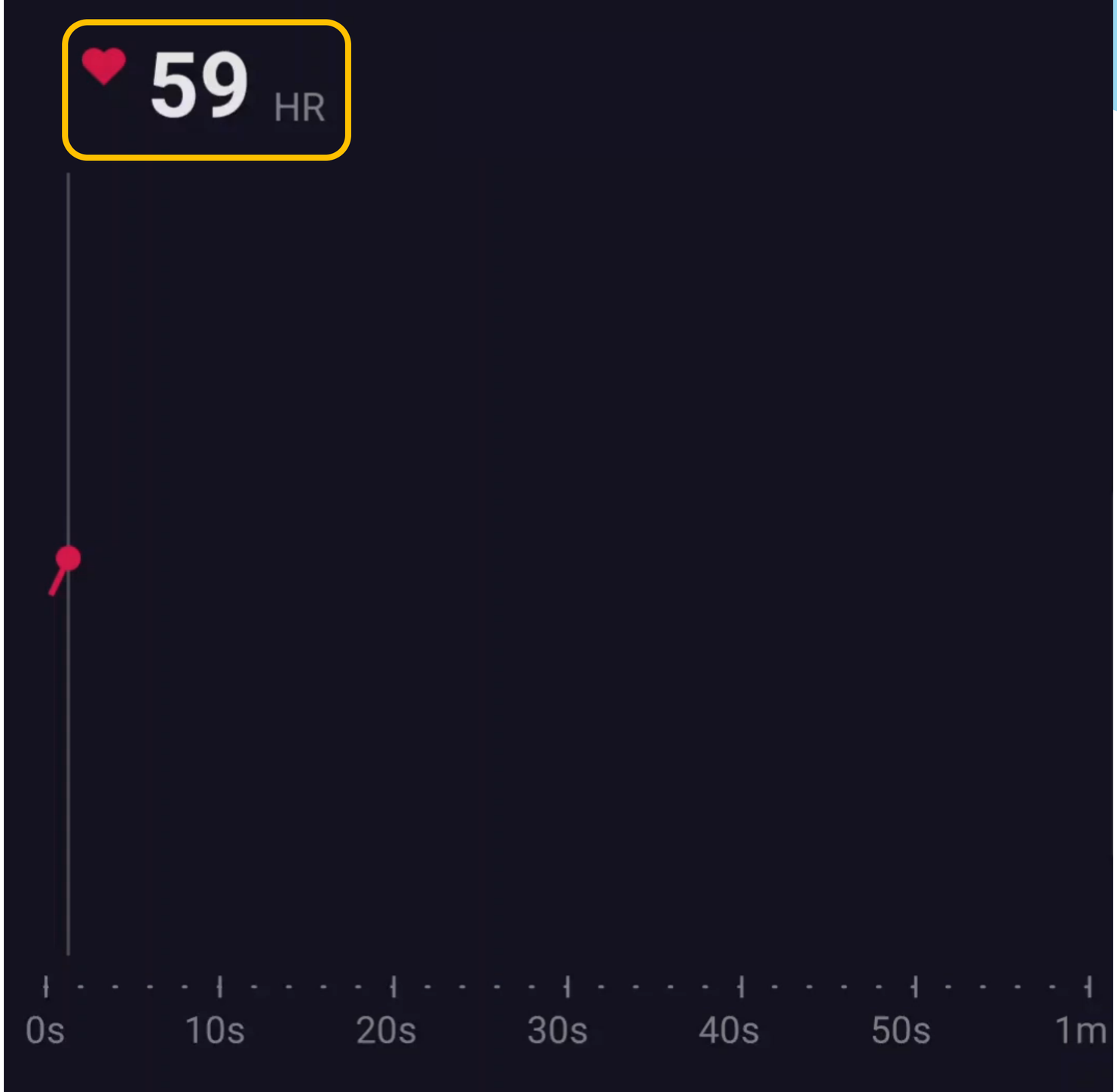
Escorihuela et al 2020



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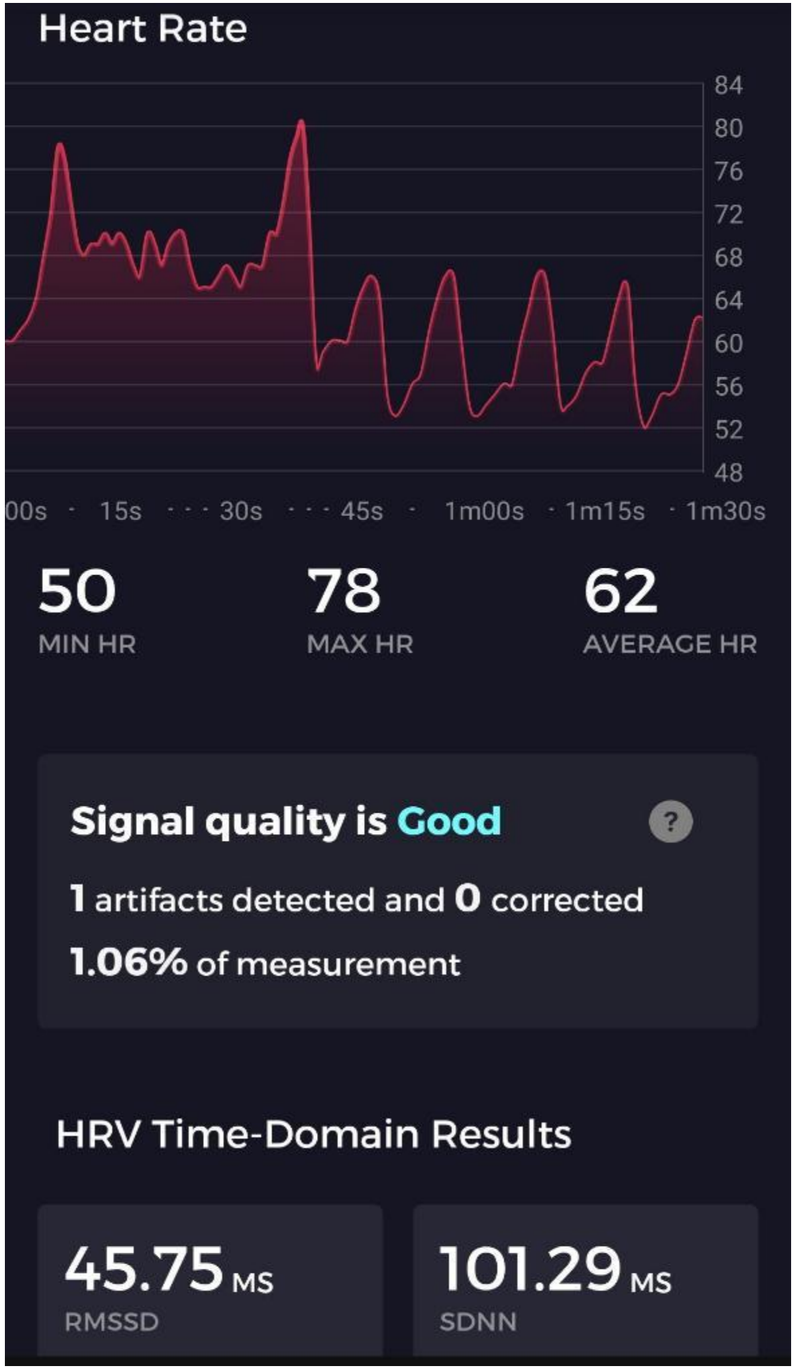
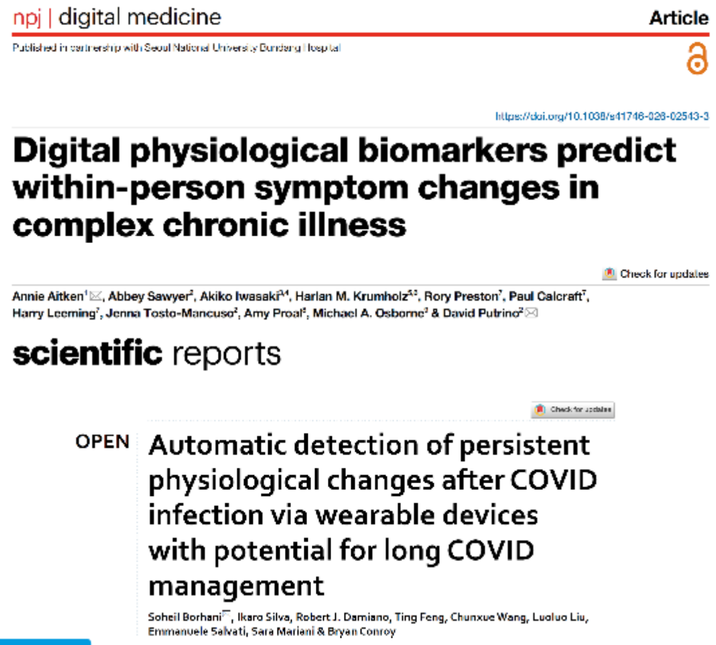

Heart Rate
84
80
76
72
68
64
60
56
52
48
00s · 15s · · · 30s · · · 45s · 1m00s · 1m15s · 1m30s
50
MIN HR
78
MAX HR
62
AVERAGE HR
Signal quality is Good
1 artifacts detected and 0 corrected
1.06% of measurement
HRV Time-Domain Results
45.75 MS
RMSSD
101.29 MS
SDNN

What does the research say about HRV?

ME/CFS, POTS and more recently Long Covid have shown altered HRV when compared with the general population.



npj | digital medicine

Article

Published in partnership with Seoul National University Bundang Hospital

https://doi.org/10.1038/s41746-026-02543-3

Digital physiological biomarkers predict within-person symptom changes in complex chronic illness

Check for updates

Annie Aitken[1], Abbey Sawyer[2], Akiko Iwasaki[3,4], Harlan M. Krumholz[5,6], Rory Preston[7], Paul Calcraft[7], Harry Leeming[7], Jenna Tosto-Mancuso[2], Amy Proal[2], Michael A. Osborne[7] & David Putrino[2]

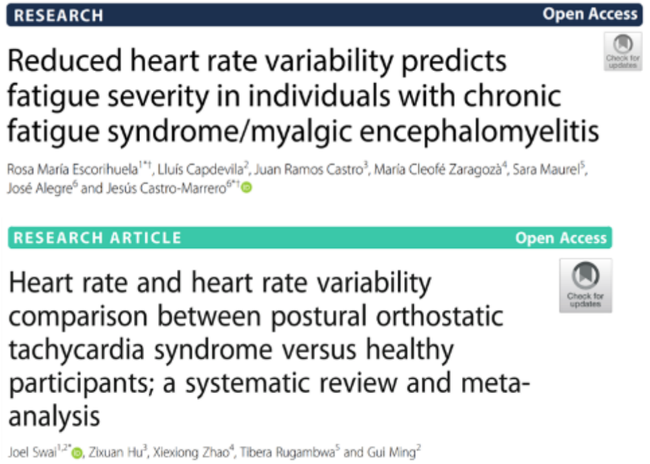
scientific reports

Check for updates

OPEN

Automatic detection of persistent physiological changes after COVID infection via wearable devices with potential for long COVID management

Soheil Borhani, Ikaro Silva, Robert J. Damiano, Ting Feng, Chunxue Wang, Luoluo Liu, Emmanuele Salvati, Sara Mariani & Bryan Conroy



RESEARCH

Open Access

Reduced heart rate variability predicts fatigue severity in individuals with chronic fatigue syndrome/myalgic encephalomyelitis

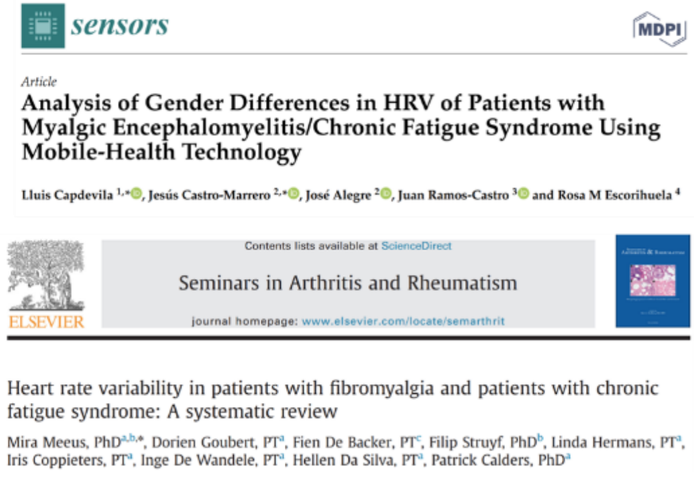
Rosa María Escorihuela[1*†], Lluís Capdevila[2], Juan Ramos Castro[3], María Cleofé Zaragozà[4], Sara Maurel[5], José Alegre[6] and Jesús Castro-Marrero[6*†]

RESEARCH ARTICLE

Open Access

Heart rate and heart rate variability comparison between postural orthostatic tachycardia syndrome versus healthy participants; a systematic review and meta-analysis

Joel Swai[1,2*], Zixuan Hu[3], Xiexiong Zhao[4], Tibera Rugambwa[5] and Gui Ming[2]



sensors

MDPI

Article

Analysis of Gender Differences in HRV of Patients with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome Using Mobile-Health Technology

Lluis Capdevila [1,*], Jesús Castro-Marrero [2,*], José Alegre [2], Juan Ramos-Castro [3] and Rosa M Escorihuela [4]

ELSEVIER

Contents lists available at ScienceDirect

Seminars in Arthritis and Rheumatism

journal homepage: www.elsevier.com/locate/semarthrit

Heart rate variability in patients with fibromyalgia and patients with chronic fatigue syndrome: A systematic review

Mira Meeus, PhD[a,b,*], Dorien Goubert, PT[a], Fien De Backer, PT[c], Filip Struyf, PhD[b], Linda Hermans, PT[a], Iris Coppieters, PT[a], Inge De Wandele, PT[a], Hellen Da Silva, PT[a], Patrick Calders, PhD[a]

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Aitken et al 2026; Borhani et al 2025 Capdevila et al 2021; Escorihuela et al 2020; Meeus et al 2013; Swai et al 2019

What does the research say about HRV?

Sports Medicine
https://doi.org/10.1007/s40279-026-02487-4

ORIGINAL RESEARCH ARTICLE

Wearable Heart Rate Variability Monitoring, Autonomic Dysfunction and Post-exertional Malaise in Long COVID: An Observational Study

Twan M. Ruijgt[1] · Anouk Slaghekke[1] · Anneke Ellens[2] · Kasper W. Janssen[2] · Rob C. I. Wüst[1]

Accepted: 18 June 2026

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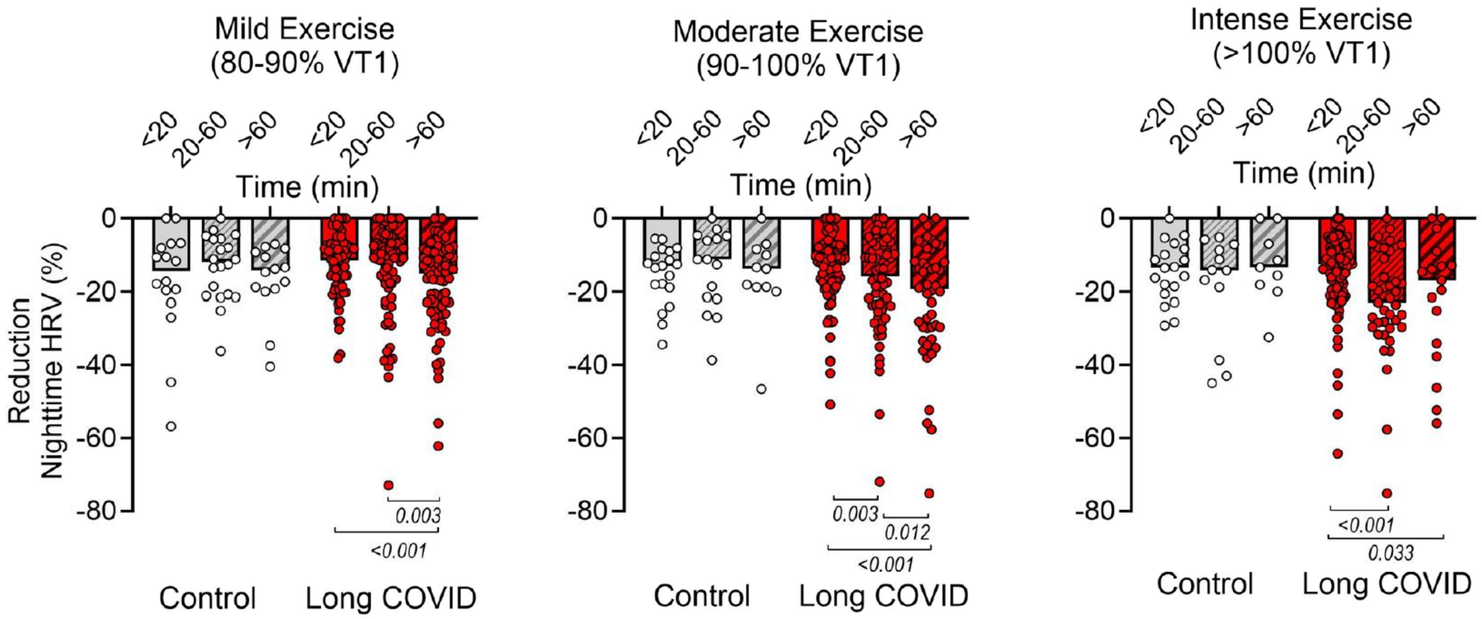
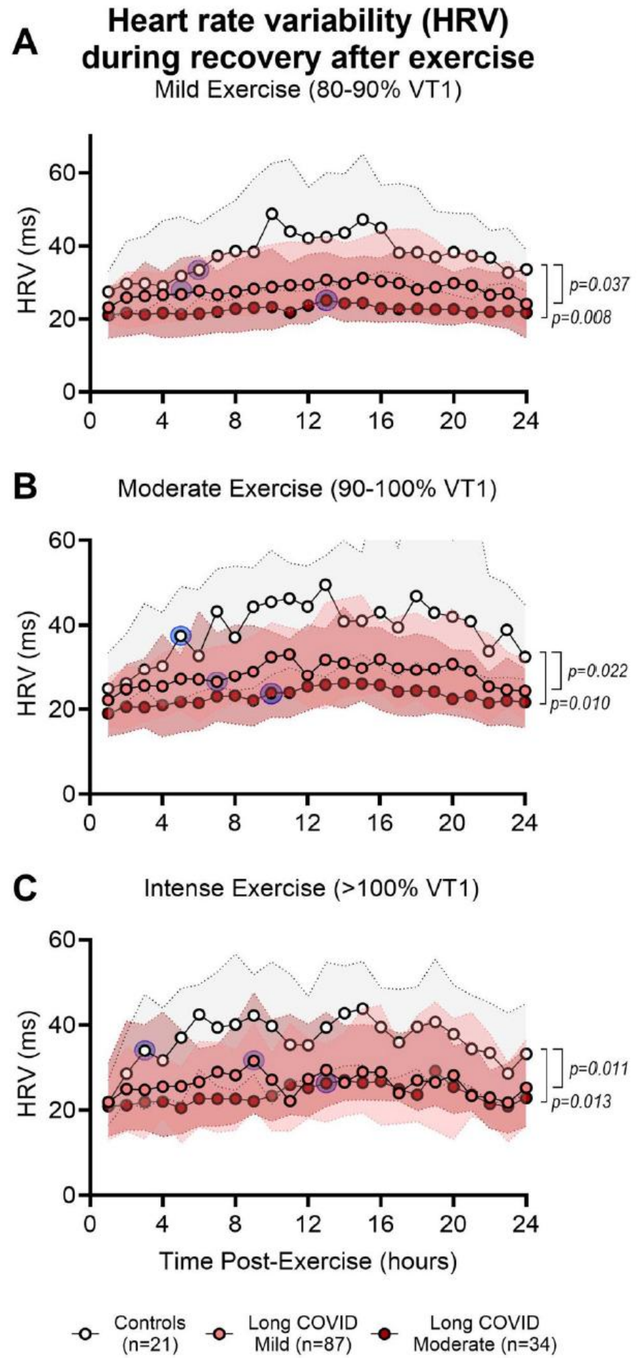
What does the research say about HRV?

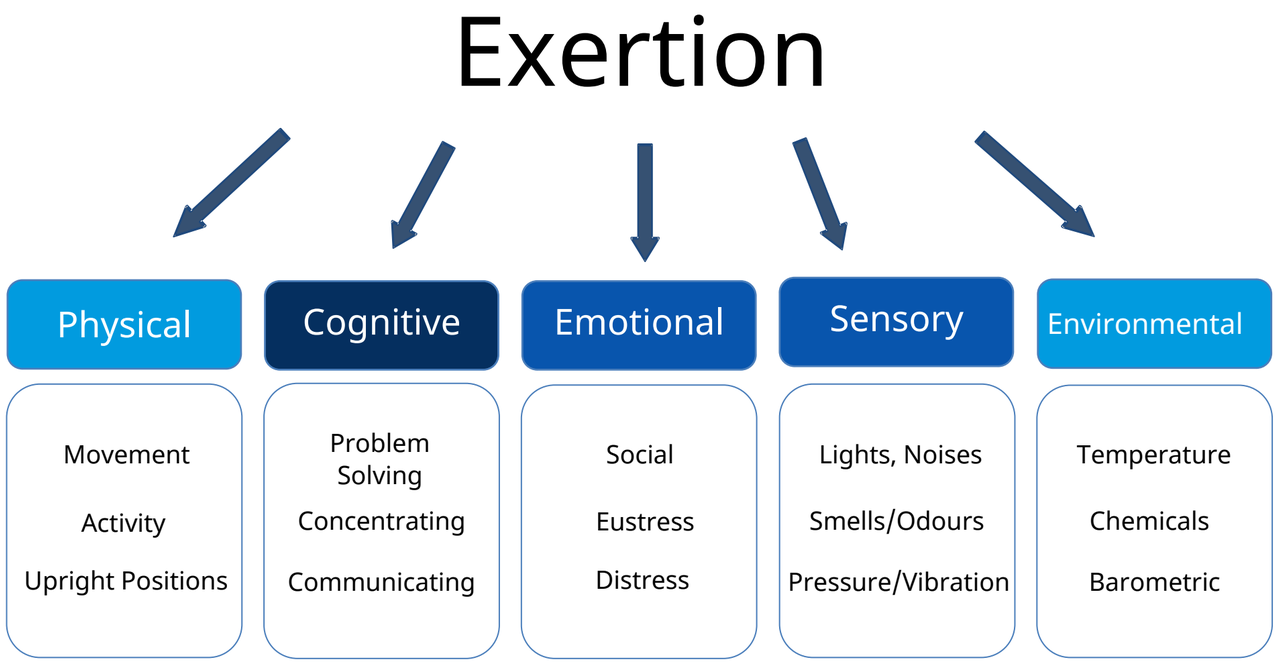




Ruijgt et al 2026

A note about using HRV for ME/CFS

HRV is very sensitive, but not specific… Therefore, context is crucial for appropriate use.



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In simple terms…

HRV gives us some insight into if someone has recovered back to their baseline from the demands of the previous day/s.

How many “spoons” have they got for the day ahead.

= VERY HANDY FOR PACING!

How to monitor HRV

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Decision 1 – PPG or ECG

- Optical devices (PPG):
  - Phone camera via a compatible app
  - Smart device (watch/ring/band) with compatible app
- Chest strap (ECG):
  - Such as Polar H10, Garmin HRM-dual, Coospo H8
  - Must be paired with compatible app

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Decision 1 – PPG or ECG

Pros	Cons
PPG	
App versions free or low cost	Wearable devices can be quite pricey
Easily accessible	Despite “good correlation”, still not as accurate as ECG
Some apps (eg Visible) have been designed for ME/CFS	Measurement method variance (eg finger on camera)
Easier to conduct morning check in/overnight measure	
ECG	
Best accuracy	Can have issues with artifacts if contact against skin not ideal
Apps free or low cost	Requires the purchase of a chest strap ($60-$150) which needs to be in place to conduct morning check in
Dedicated chest straps usually run on coin-cell batteries that last for months	Captures morning check in data only – not designed to capture overnight averages as with wearable devices

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💡 **Summary**

- **Choose PPG** if convenience and/or continuous overnight tracking.
- **Choose ECG** if absolute precision and spot-check reliability.

Decision 2 – Morning check-in or overnight

Both provide a standardised measure of HRV:

1. Morning check-in - most common apps include:

- Visible (PPG)
- HRV4Training (PPG or ECG)
- Welltory (PPG or ECG)
- EliteHRV (ECG)

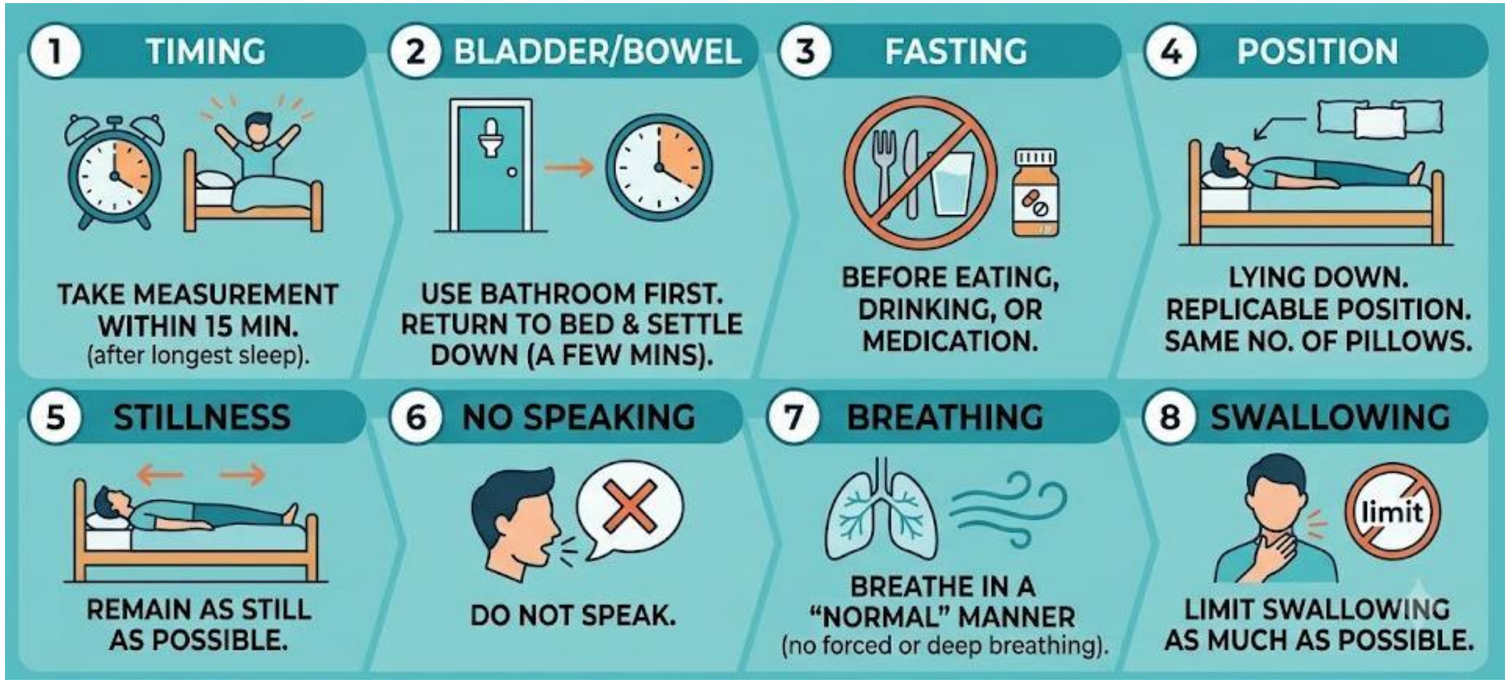
Visible: Long Covid & ME/CFS 17+
Activity tracking for illness
Visible Health Inc. (US)
★★★★★ 4.9 • 73 Ratings
Free

HRV4Training 4+
A.S.M.A. B.V.
#16 in Health & Fitness
★★★★★ 4.2 • 38 Ratings
$14.99

Welltory: Heart Rate Monitor
Stress, Pulse & HRV Analyzer
Welltory inc
#74 in Health & Fitness
★★★★★ 4.7 • 30.7K Ratings
Free · Offers In-App Purchases

To ensure morning check-in accuracy

HRV is a very sensitive measure which requires a consistent routine to ensure test-retest accuracy



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Decision 2 – Morning check-in or overnight

2. Overnight average HRV measure are <u>all PPG</u> wearable devices – most commonly:

- Apple watch (requires 3rd party app to access overnight HRV) – Bevel or HeartWatch
- Garmin (only newer devices have overnight HRV)
- Google/Fitbit (caution with native baseline calculation)
- Samsung (Watch 5 or newer)
- Oura/Ultrahuman ring (caution composite health scores)
- Whoop

Choose 1 option and "stick with it" to allow direct comparison

Each app/device works slightly differently, making it challenging to compare one app against another for interpretation

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Tips for integrating HRV guided pacing into your clinical practice

5 KEY STEPS FOR HRV-BASED DAILY PLANNING

Step 1

Gathering accurate HRV data.

Step 2

HRV is best to be used alongside subjective symptoms for the day.

Step 3

Capacity adjustment required?

Step 4

Plan for the day ahead.

Step 5

Trend over time, what does it mean?

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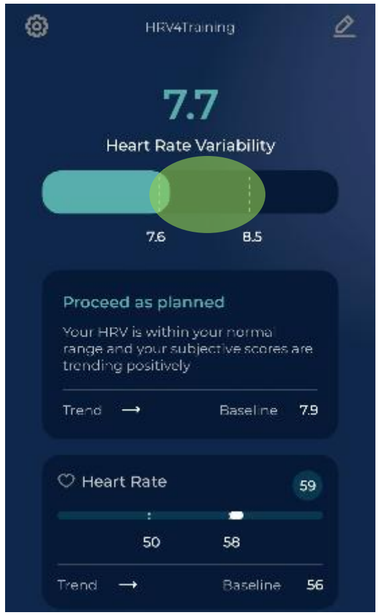
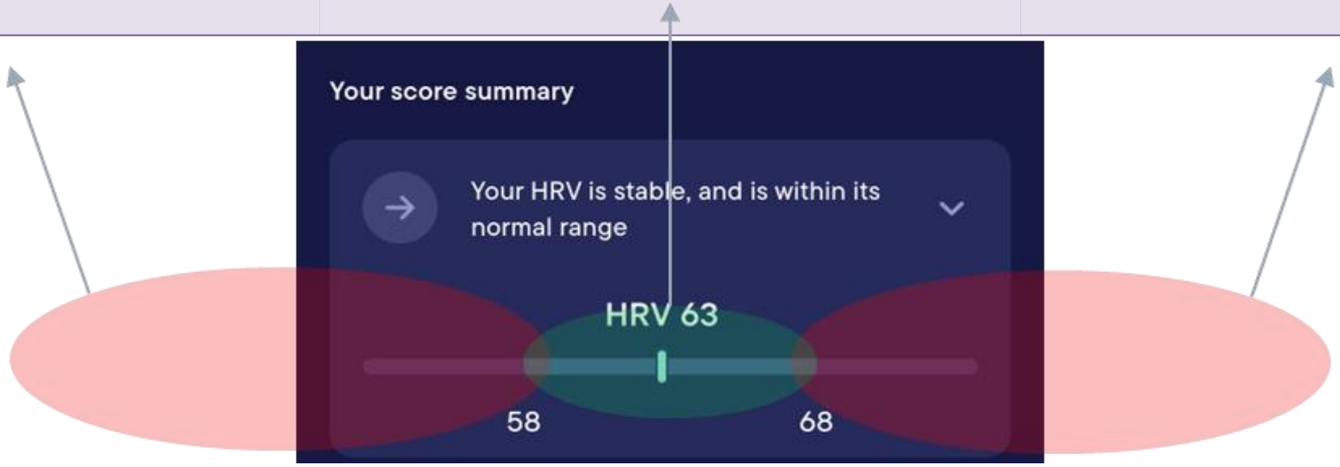
Most HRV apps and wearables give similar information, but display it slightly differently

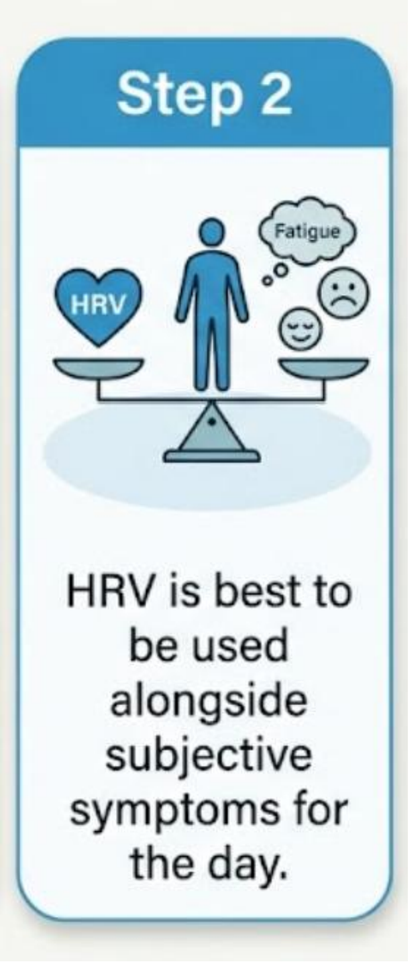
- A “baseline range” for the individual (both HRV and resting HR can be useful here)
- Where the HRV/RHR are on a particular day compared to the “baseline range”



How does the HRV/RHR data compare with subjective symptoms for the day?

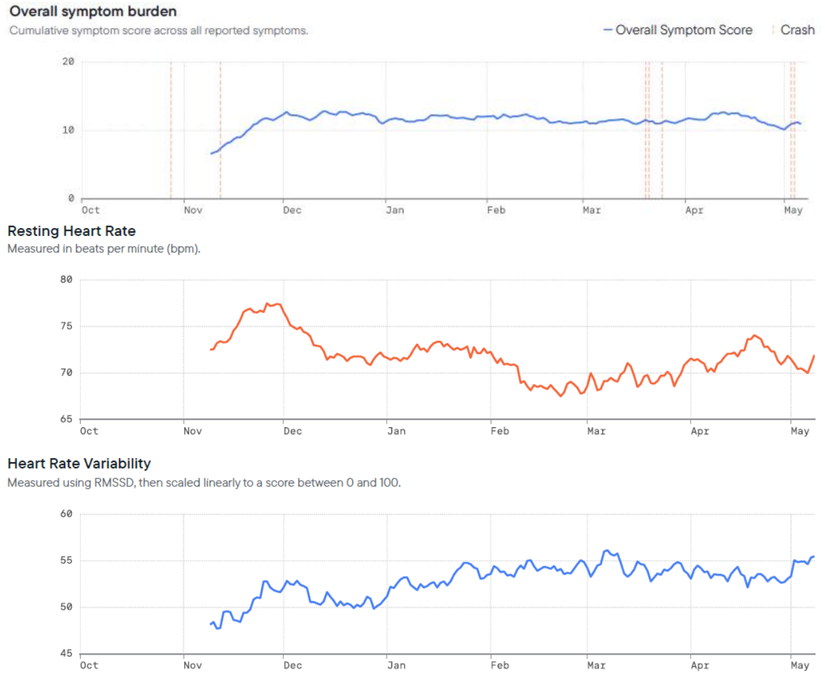
Overly sympathetic (fight-flight)	Better balance between sympathetic and parasympathetic	Overly parasympathetic (freeze)
More likely to feel: • Overly fight-flight (possible trigger for a setback) • Exhaustion from too much adrenalin • Tense muscles and increased sweat • Dry eyes and more sensitive to light/noise • Faster breathing and heart rate • Physiological “anxiousness” from adrenalin • Angry, frustrated, anxious, irritable • Usually higher resting HR	More likely to feel: • Slightly more calm or alert • Slightly more open to social contact • Slightly better regulation of heart rate and blood pressure *On these days someone may not feel “normal” but their body has been able to recover back to their current baseline from the demands of the day/s prior and therefore will be more resilient to the demands of the day ahead*	More likely to feel: • Overly lethargic (possible setback beginning or already started) • Exhaustion from being lethargic • Slack muscles and heavy eyelids • Not want social contact • Shallow breathing and slower heart rate • Likely lower blood pressure • Sad or down • Usually lower resting HR





Symptom diaries

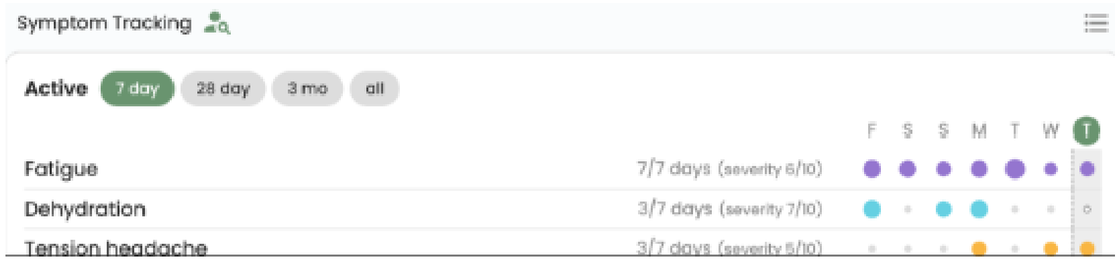
- Can help provide additional subjective insights into management
- Short-term is best as they do require cognitive energy to complete
  - Especially helpful when altering management
- 3-5 symptoms
  - Worst
  - New-onset
  - Areas to monitor

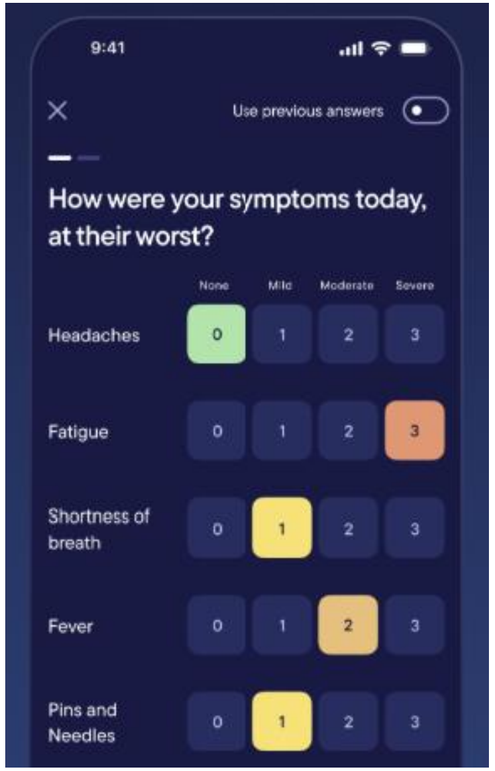


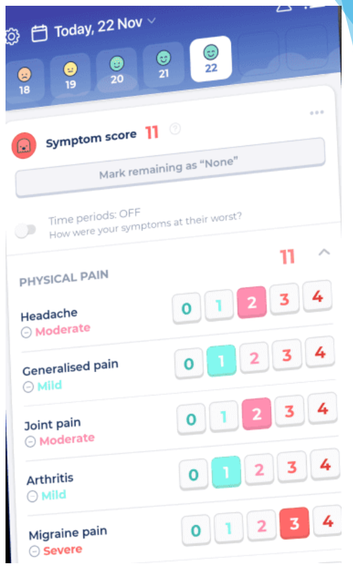
Symptom diaries

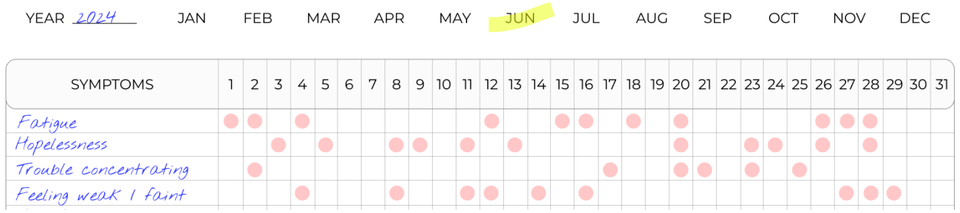
Types:

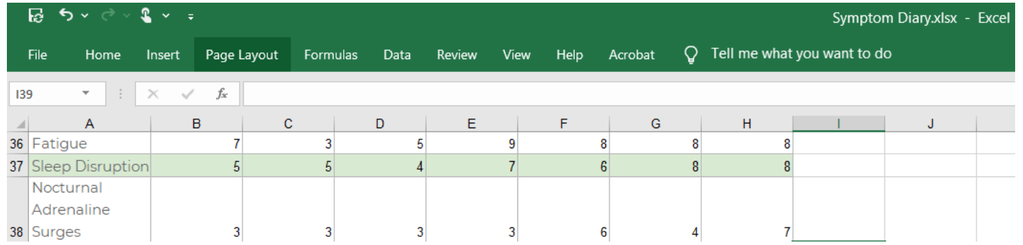
- Paper diary
- App – Guava, Visible, Bearable etc
- Digital diary – Excel, Google/Apple calendar











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Activity diaries

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Date	26-Oct	27-Oct	28-Oct	29-Oct	30-Oct	31-Oct	1-Nov
Weather	Sunny 21	Cloudy 19	Sunny 26	Sunny 28	Rain 18	Cloudy 20	Sunny 22
the AM?	5/10	5/10	5/10	3/10	2/10	5/10	6/10
7am	Sleep	Sleep	Sleep	Sleep	Sleep	Sleep	Sleep
8am	Breakfast	Sleep	Breakfast	Breakfast	Breakfast	Breakfast	Sleep
9am	Relax then drive	Breakfast	Uni work	Relax	Work	Relax	Sleep
10am	Brunch w friend	WFH	Uni work	Drive	Work	Uni work	Breakfast
11am	Drive home	WFH	Work	Appointment	Work	Uni work	With partner
12pm	Lunch	Lunch	Work	Drive	Lunch	Lunch	With partner
1pm	Uni work	WFH	Lunch	Lunch	Work	Umpire hockey	Lunch
2pm	Uni work	WFH	Work	Relax	Work	Umpire hockey	Visit friends
3pm	Uni work	Reading	Work	Relax	Relax	With partner	Visit friends
4pm	With partner	Reading	Work	Gym	Relax	With partner	Visit friends
5pm	Gym	Dinner	Uni work	Dinner	Dinner	With partner	Visit friends
6pm	Dinner	Walk w friend, emotional	Uni work	With partner	With partner	Dinner	Dinner
7pm	With partner	With partner	Dinner	With partner	With partner	With partner	With partner
8pm	With partner	With partner	With partner	Sleep	With partner	With partner	With partner
9pm	Sleep	With partner	Sleep	Sleep	With partner	With partner	Sleep
10pm	Sleep	Sleep	Sleep	Sleep	Sleep	Sleep	Sleep
the PM?	5/10	6/10	4/10	2/10	4/10	5/10	5/10

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“Capacity adjustment” required for the day ahead?

Depending on where someone’s HRV is for the day, may impact how many “spoons” are allocated for the day.

- For example:
- Overly sympathetic -2 spoons
- Overly parasympathetic -3 spoons

Plan for the day ahead.

- How is someone feeling?
- What is their HRV measure?
- How many “spoons” have they got for the day?

My Daily Task List

Cognitive	Physical	Restful

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Step 4

Plan for the day ahead.

Example low HRV day	Example high HRV day
Extra diligent with alternating between: • Physical tasks • Cognitive tasks • Restful moments	
Extra diligent with Microbreaks, especially with cognitive tasks: • 15/30/60sec breaks not doing what they are currently doing • Check in with jaw/shoulders (relax them), breathing/heart rate (1-2 deep breaths), leg pain/pins needles/discolouration (ankle pumps/circles, slight leg movements) • Pomodoro timers can be useful here	
?Structured movement? • May choose to perform some easier movement than "usual" to use up some of the extra adrenalin, but caution not to push too hard to cause another release of adrenalin. Using up this adrenalin means it is less likely to impact the night's sleep (tired and wired feeling)	?Structured movement? • Best to prioritise complete rest
Incorporate a few relaxation activities	
Aim to do more Vagus nerve stimulation exercises than usual (tVNS, deep breathing, mindfulness and meditation etc)	Can get by with slightly less Vagus nerve stimulation exercises than usual (tVNS, deep breathing, mindfulness and meditation etc). Especially if these leave someone feeling more fatigued afterwards.
?Extra caffeine may leave someone more on edge	?Extra caffeine more likely to be ok
Add extra electrolytes on these days (extra salty foods or extra electrolyte drink)	

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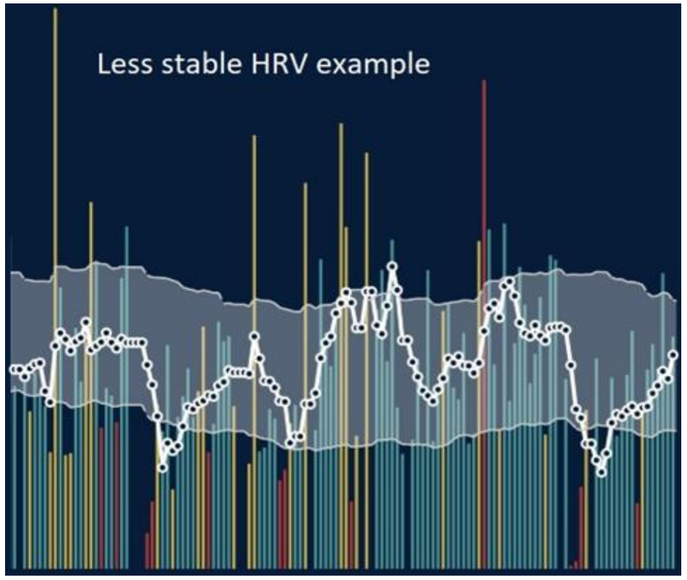
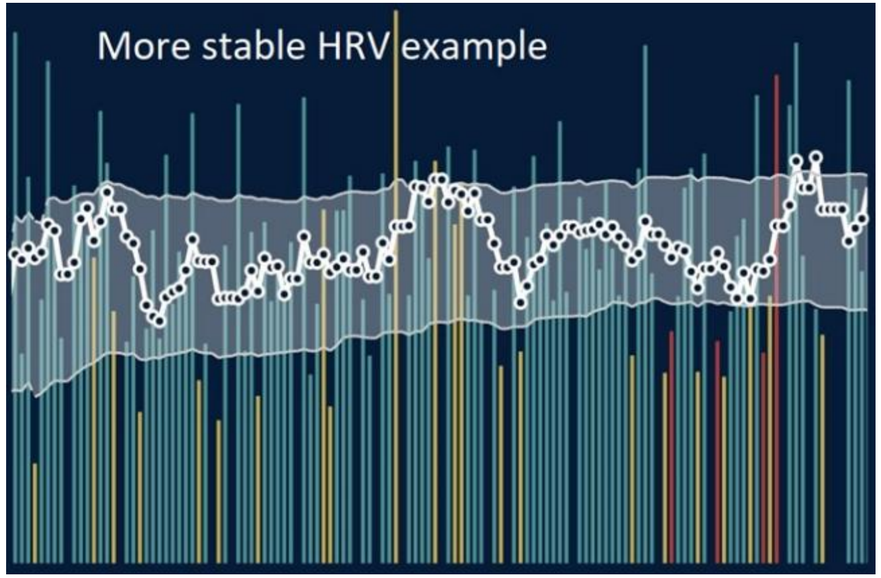
Trend over time, what does it mean?

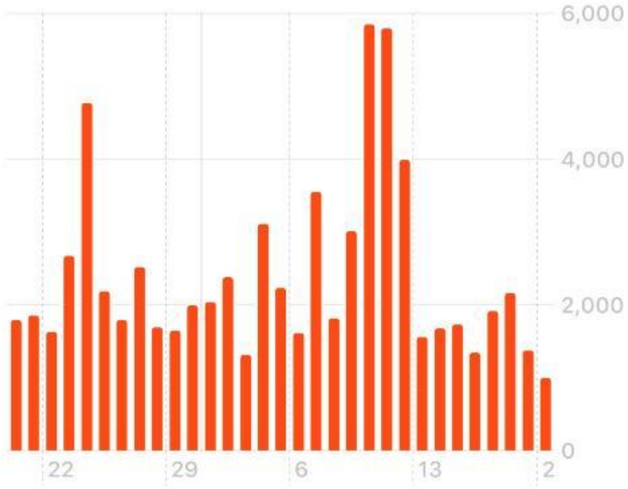
- HRV trends over weeks or months help to identify long-term adaptation to demands (stress).
- For example, we may expect to see a change in trend due to a hormonal cycle or a period of worsening fatigue.
- In general, stability should be the aim - stability doesn't mean a lack of stress, but how well the body responds to the stressful event.
- If someone is able to cope and respond reasonably well to the stressors they face, HRV will "bounce back" quicker and this is highlighted as a more stable HRV trend.





How GPs can assist with data-driven pacing

- People with ME/CFS *desperately* want to improve their QoL and function.
  - Therefore, measuring and providing data is a way they can make their condition more visible to medical and health providers.
  - It's not a health anxiety behaviour
- Look for:
  - A boom-bust pattern with activity (steps can be helpful here)
  - If looking at HRV or resting HR data, use the 1 month or 3 month view to assess trend over time (boom-bust pattern)
- Consider:
  - Referral out to a ME/CFS aware allied health provider (EP/OT/Physio)



Device tips

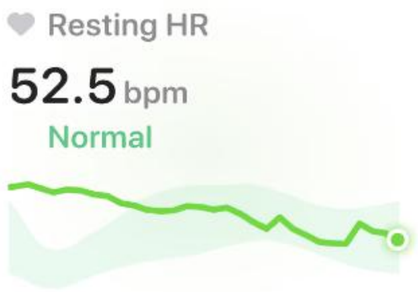

10:09
now
High Heart Rate
Your heart rate rose above 120 BPM while you seemed to be inactive for 10 minutes starting at 9:59 AM.
186
120
60

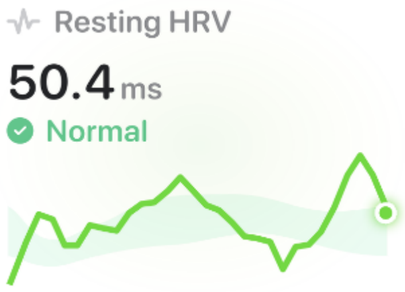
Apple Watch

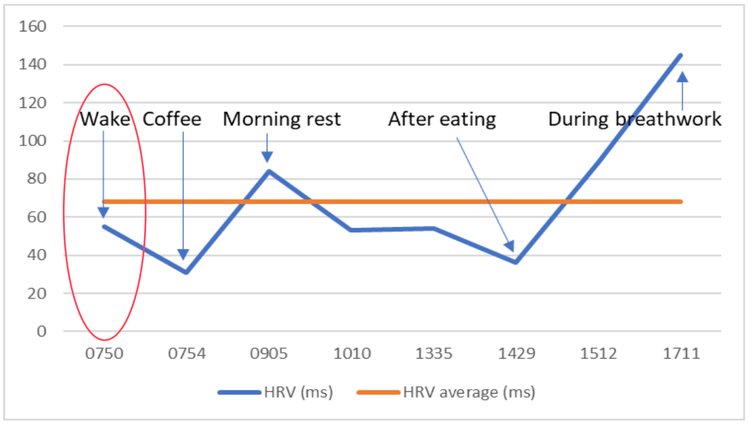
TachyMon or Beatwatcher apps are useful for HR alerts

HRV is best to be used with a 3rd party app:

- HRV 4 Training or Welltory (morning check in)
- Bevel (overnight)







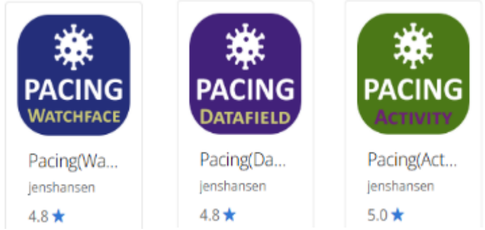
Bevel; HRV4Training; TachyMon

Garmin

In-built HR alerts - can only use during an "activity"

Searchable user manual – contains <u>everything!</u>

- Really useful for brain fog



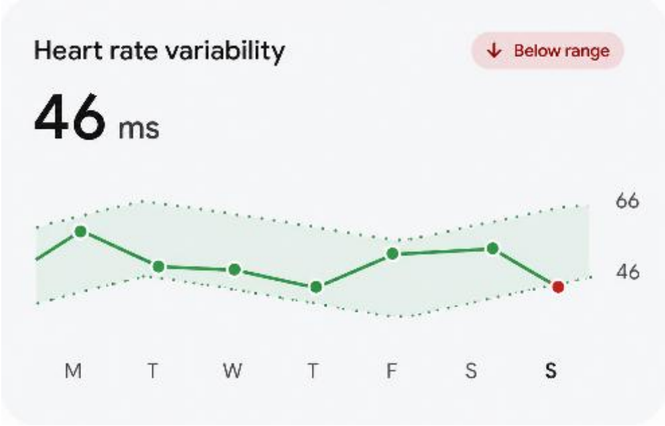
Google/Fitbit

In-built HR alerts – much harder to activate – need to adjust your HR activity zones. Can only use during an "activity"

Health metrics – 30 day view

- HRV
- Resting HR

**Often "fits" all data points into the normal range



Galaxy watch

In-built HR alerts – much harder to activate – need to adjust your HR activity zones. Can only use during an "activity"

Energy score only available to Watch5+

“Stress” & “battery” measures

Also called “composite health scores” (CHS)

- Doherty et al (2025) conclusion: “While the concept of CHS represent a promising innovation in digital health, their scientific validity, transparency, and clinical applicability remain uncertain.”
- Most are proprietary algorithms made up of HR, RHR, HRV, activity and sleep data

DE GRUYTER

Transl. exerc. biomed. 2025; aop

Review Article

Cailbhe Doherty*, Maximus Baldwin, Rory Lambe, David Burke and Marco Altini

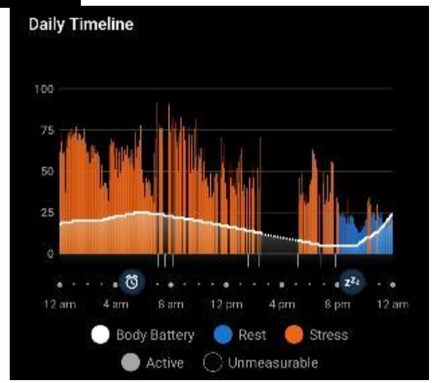
Readiness, recovery, and strain: an evaluation of composite health scores in consumer wearables

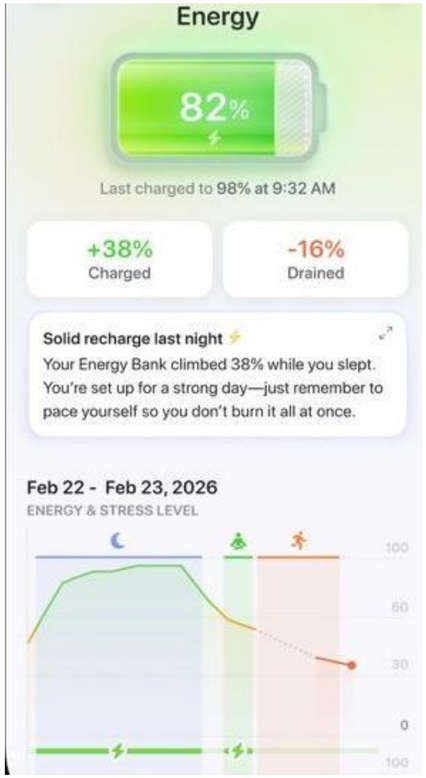
https://doi.org/10.1515/teb-2025-0001
Received January 30, 2025; accepted March 28, 2025;
published online April 10, 2025

Doherty et al 2025

“Stress” & “battery” measures

Generally ”reward” overly-parasympathetic states and “penalise” overly-sympathetic states, but once calibrated and people are made aware of their limitations, can be very useful for management.





Garmin; Bevel; StressWatch

Questions

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