



DIPPING (DECELERATION) IN CARDIAC AUTONOMIC NEUROPATHY

SPALLONE 2011

- At night, normal individuals exhibit reduction in nocturnal blood pressure, associated with predominance of vagal tone **and** decreased sympathetic activity.
 - *Diabetic patients with CAN result in a pattern of **sympathetic tone during night and development of nocturnal hypertension.***
 - This is associated with a development of left ventricular hypertrophy and increased CV morbidity and mortality rate in patients with DM and CAN.
- Nighttime blood pressure is one of the best predictors of CV events. A Cochrane review found that bedtime dosing of antihypertensives reduced sleep blood pressure. One study conducted in Spain found that bedtime dosing of one or more antihypertensives significantly reduced CV events. Carter 2014

STUCK IN FIBROMYALGIA

CHERVIN 2009

- Decreased HRV in Fibromyalgia; multiple studies
- EEG failed to distinguish FMS & control subjects
- **HRV most sensitive discriminators** between FMS and control subjects
 - Marked decrease in HF power
- Significant group difference in **nighttime HRV** between FMS and control subjects
- **Persistent and inflexible sympathetic predominance** across the circadian cycle may play a key role in fibromyalgia

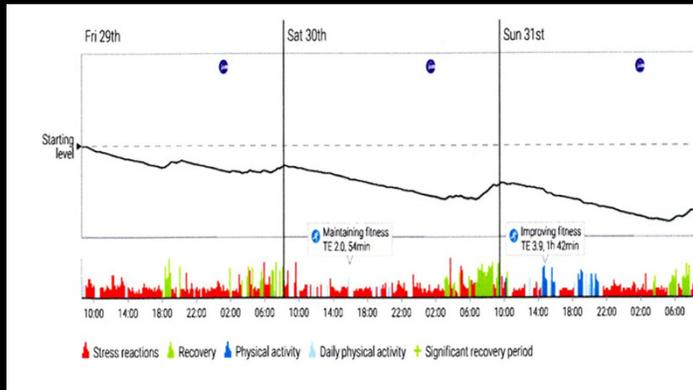
DECREASED NIGHTTIME HRV IS ASSOCIATED WITH INCREASED STROKE RISK

COPENHAGEN HOLTER STUDY. BINICI 2011

- Stroke onset has a diurnal onset. We hypothesized that HRV with a focus on nighttime HRV will predict the risk of stroke in apparently healthy subjects.
- Methods: **678 healthy randomized subjects between age 55 and 75 years with no history of CV disease or stroke**. 48-hour ambulatory electrocardiogram monitoring. Nighttime HRV was measured between **2:00 and 2:15 AM**. Median follow-up was 76 months.
- Results: 81% of all strokes (21/26) occurred in 330 subjects with the reduced HRV (lower half of nighttime SDNN)
- CONCLUSION: **Nocturnal HRV is a strong marker** for the development of stroke in apparently healthy subjects. Reduced parasympathetic activity increases the risk of stroke

PEOPLE ONLY SEE WHAT THEY ARE PREPARED TO SEE

Ralph Waldo Emerson



After seeing,
Olivia adapts. 2015

INTENTIONAL RECOVERY

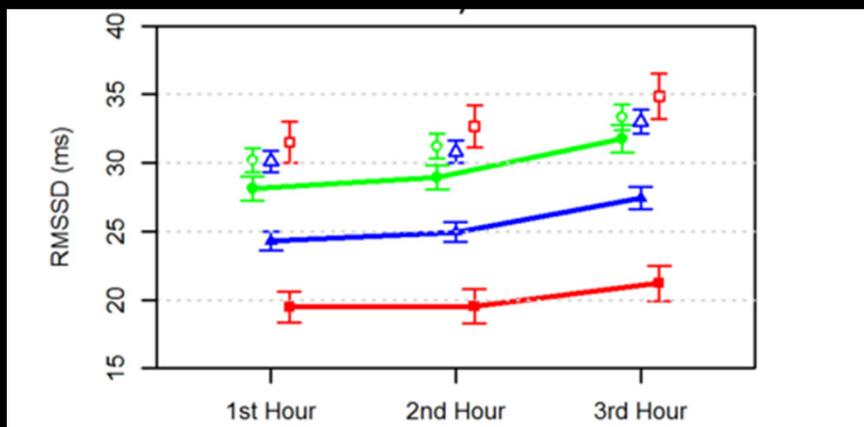


INTENTIONAL RECOVERY

...valuing, understanding and measuring PNS health

• R. Gharbo. Baer Lectureship. OSUMC. May 11, 2018

OBSERVATIONAL (REAL WORLD) STUDY OF EVENING ALCOHOL CONSUMPTION
 J. PIETILA, MARCH 2018 N=4098 EMPLOYEES
 SINGLE LEAD EKG OVERNIGHT RECORDINGS



Compared to no alcohol consumption

-Low dose alcohol

-Moderate dose

-Heavy dose

BDNF. Deng 2016

• **Countless studies have shown the therapeutic potential of BDNF in promoting axonal regrowth**, preserving synaptic strength, sparing neuronal loss in a number of neurodegenerative disease models, and facilitating reinnervation of neurons in acute CNS injury.

• BDNF potentiates neuronal circuitry by modulating synaptic efficiency. Exogenous BDNF increases rodent brain slices of the hippocampus in the post-synapse of excitatory neurons, important functions for learning.

• Irradiation in mice **arrests hippocampal neurogenesis resulting in impaired contextual fear conditioning**. BDNF enhances neurogenesis in cultured hippocampal neurons (depression).^{65,66} Multiple studies demonstrate BDNF promotes axonal regeneration and **rewiring of injured nerve fibers**.

HRV & BDNF. Kadoya 2014

CIRCADIAN REHABILITATION

- 5/11/17. LOC >20 minutes.
- Hopeful moment. 6/20/17. "put me in a nursing home". Stuck & Ready. On dextroamphetamine prn, hypertensives & SSRI
- Ah ha moment 8/25/17. Pit stop at the food court. Pieced together how her energy choices affect how she feels and her performance.
- Welcome back moment. 3/21//18. Return to work full duty off dextroamphetamine. Acquired skill to reduce BP. Reducing her BP meds.



SLEEP CAVE RECOMMENDATIONS

- Fear super highways & BDNF off ramps
- Visual, auditory, and olfactory triggers
- Breathing
 - Grateful
- Safety
 - Arguing vs safety
 - Trust; 2 levers
- Switch your beta blocker at night

THANK YOU

1.	Understand the role of reduced HRV as an indicator of stress, poor health, and mortality risk.
2.	Understand how to measure autonomic nervous system function using HRV.
	Understand the role of HRV coherence as an indicator of balanced autonomic activity, and the potential benefits of HRV biofeedback on sleep.
	Understand how to acquire and interpret HRV measures obtained during sleep.

HRV parameters reflect the functioning of the sympathetic and parasympathetic branches of the autonomic nervous system. Improvements in HRV, reflecting increased parasympathetic and decreased sympathetic activity, have emerged as reliable markers of emotional resilience, stress reduction, optimal cognitive functioning, improved physical performance, better symptom management and improved health. Elevated HRV has been associated with greater longevity. The goal of promoting "**parasympathetic health**" is to provide behavioral modification strategies that reduce unhealthy coping behaviors and shift individuals towards **self-directed health practices that promote resilience**, improve **autonomic balance**, reduce stress, and promote optimal performance and self-actualization. These interrelated health-enhancing practices are likely to both promote and benefit from optimal sleep, because sleep itself is strongly influenced by the autonomic nervous system.

The purpose of this symposium is to provide an overview of **healthy autonomic activity during sleep**; and relate HRV to sleep and sleep disorders including: **insomnia, unrefreshing sleep, short sleep, and sleep-disordered breathing**. Practices that can improve sleep and health by improving autonomic functioning during sleep will be presented. This symposium will include specific information about how to measure the functioning of the autonomic nervous system using HRV, how to acquire and interpret HRV measures obtained during sleep, and research findings about the beneficial effects of HRV biofeedback on sleep. We also propose that **cardiorespiratory phase synchronization**, a **phenomenon that occurs during restorative deep sleep**, likely serves as an underlying process that fosters parasympathetic health. Research that provides further details about the autonomic profiles seen in healthy people and those with abnormal sleep, as well as changes in these profiles resulting from practices that improve parasympathetic health, will be presented.