

# Comparative Heart Rate Variability Analysis for Patients with Severe Mitochondrial Disease

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## OBJECTIVE

Complex variability of as a measurement of the precise adjustments made to biometrics in response to and following stressors

Patients with severe mitochondrial disease compared to healthy patients

Heart rate variability chosen as one metric to analyze complexity

## BACKGROUND

Mitochondrial Stress, Brain Imaging, & Epigenetics (MiSBIE) Study

**Patients:** 70 healthy & 40 with severe mitochondrial disease

### Readings:

- Baseline after 25 minutes resting
- First samples
- Instructions for task given
- Speech preparation
- Public speech
- Post 5-120 minutes
- Deep breathing task
- Sit & stand
- Repeated sitting & standing
- Submerge hands in ice bath

## METHODS

RHRV Library for Time Series & Frequency Domain Analysis

### Time Series Analysis

- R-MSSD: compare time between consecutive beats (short-term HRV)
- SDNN: standard deviation of time between beats (overall HRV)
- HRVi: ratio of total number of heart beats to most common interval from interval histogram

### Frequency Domain Analysis:

- Continuous wavelet transformation was used to calculate HRV by estimating the power of different frequencies at different time points.

Two-sample t-tests and Wilcoxon signed rank texts were conducted per study phase between HRV measures belonging to healthy patients and those belonging to people with mitochondrial disease.

## DATA & STATISTICAL ANALYSIS

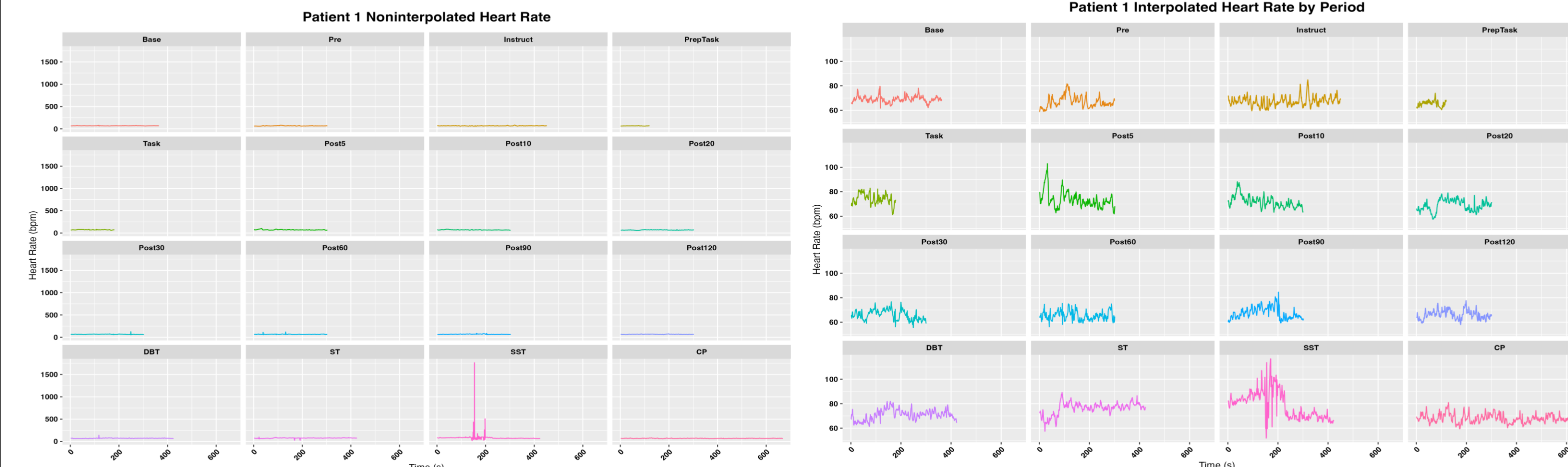
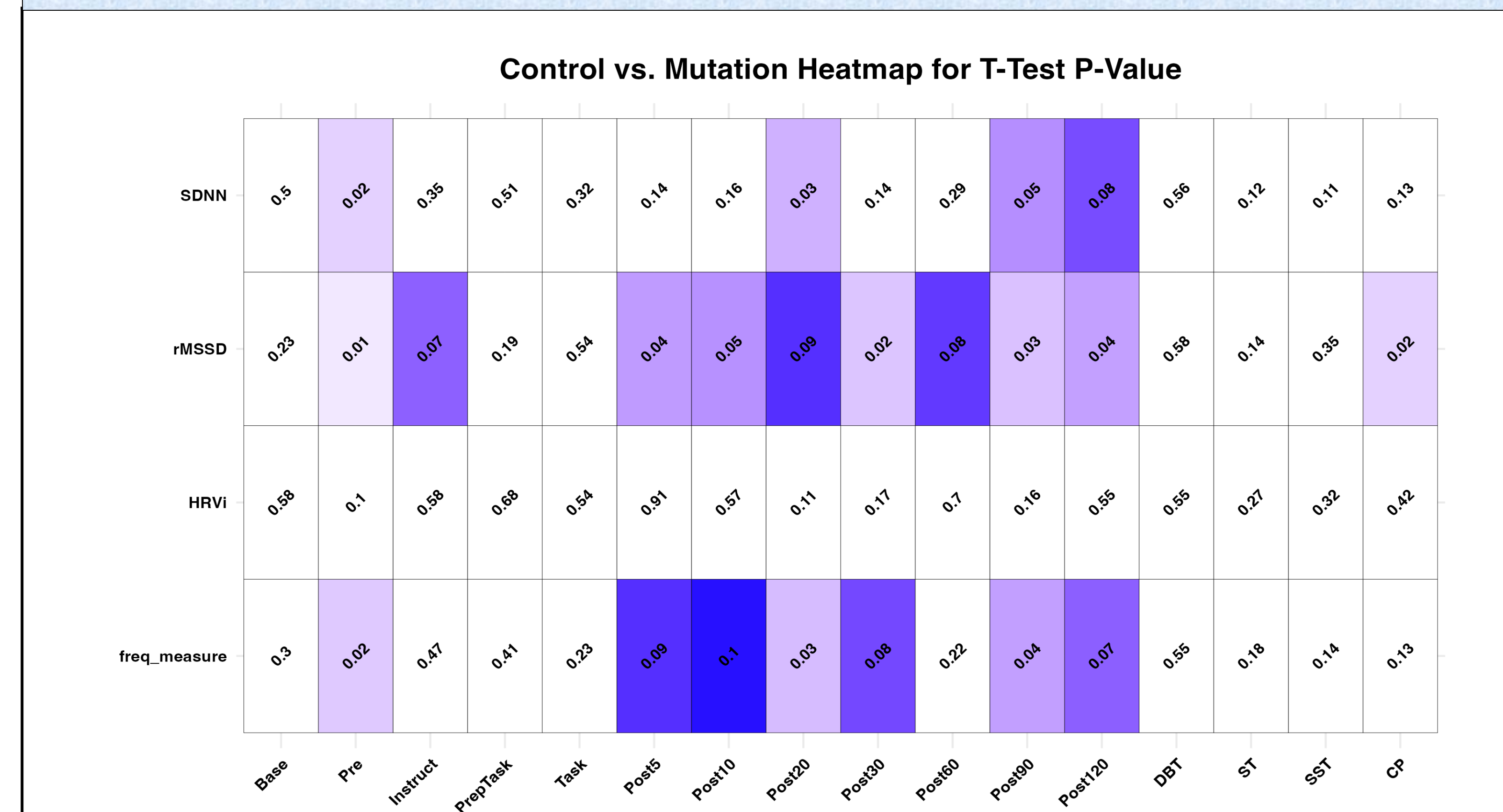


Figure 1 (top left) : Patient 1 noninterpolated heart rate with outliers as much as 1500 beats/minute

Figure 3 (bottom) Patient 1 interpolated heart rate in consecutive phase order

Figure 2 (top right): Patient 1 interpolated heart rate with abstracts (outliers) filtered

## RESULTS



## CONCLUSIONS

Many significant differences between healthy patients vs. mutation -- always with healthy patient having higher variability

Only one instance of deletion being higher than healthy

R-MSSD most common metric with higher variability

Significant differences primarily before & after stressors

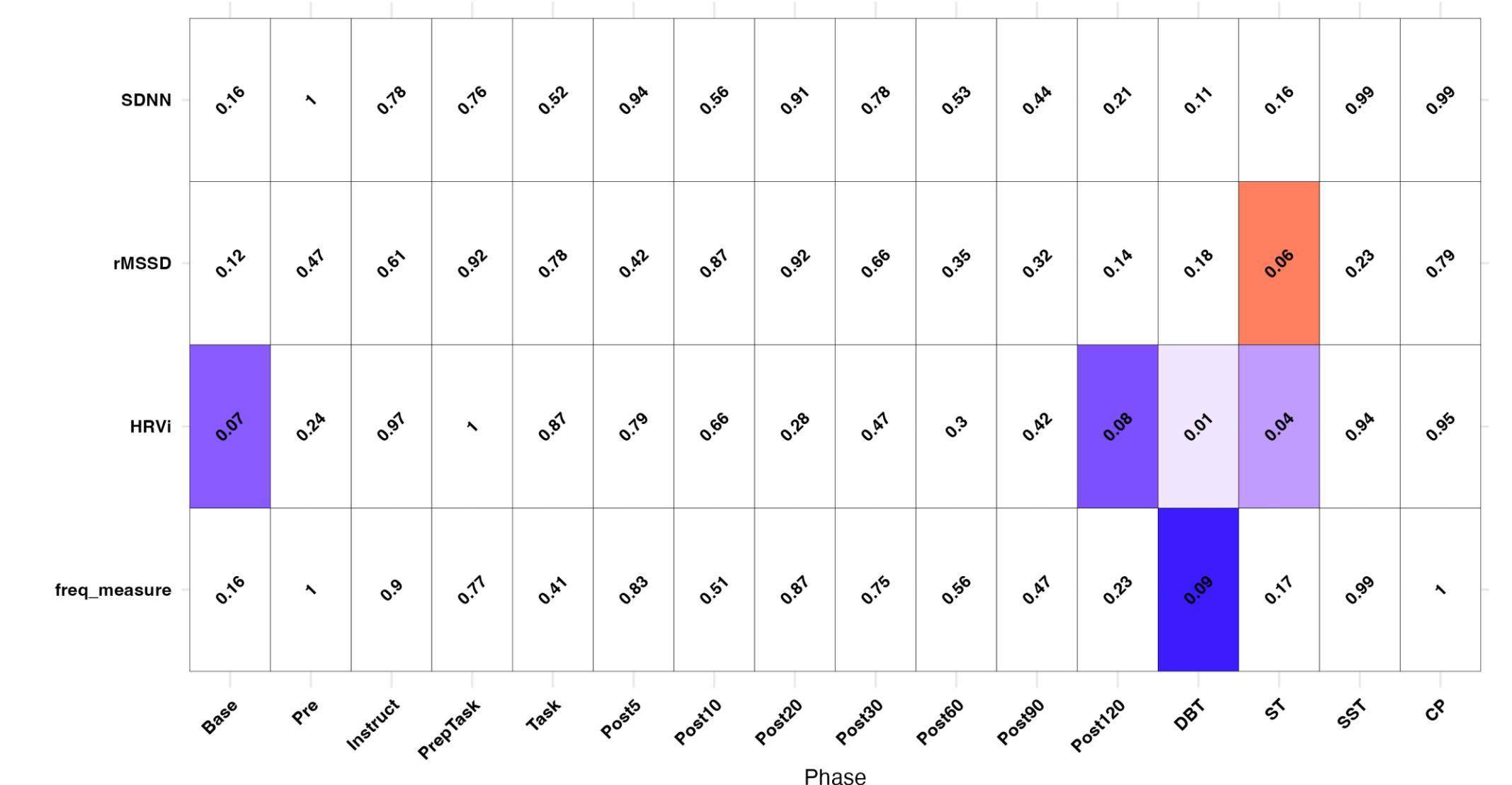
Most differences during resting period following stressors

### Limitations:

With two tests performed on four metrics for sixteen phases there are bound to be false positives

- Different metrics with non-comparable phases
- Significance level = 0.1 to allow for more positives to indicate pattern
- Correction not used for same reason
- Single instance of deletion being higher than healthy seen below

Control vs. Deletion Heatmap for Wilcoxon Test P-Value



## REFERENCES

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Lipsitz LA. *Physiological complexity, aging, and the path to frailty*. Sci Aging Knowledge Environ. 2004 Apr 21;2004(16):pe16. doi: 10.1126/sageke.2004.16.pe16. PMID: 15103055.