

# Ambulatory Blood Pressure Monitoring for Stroke Prevention

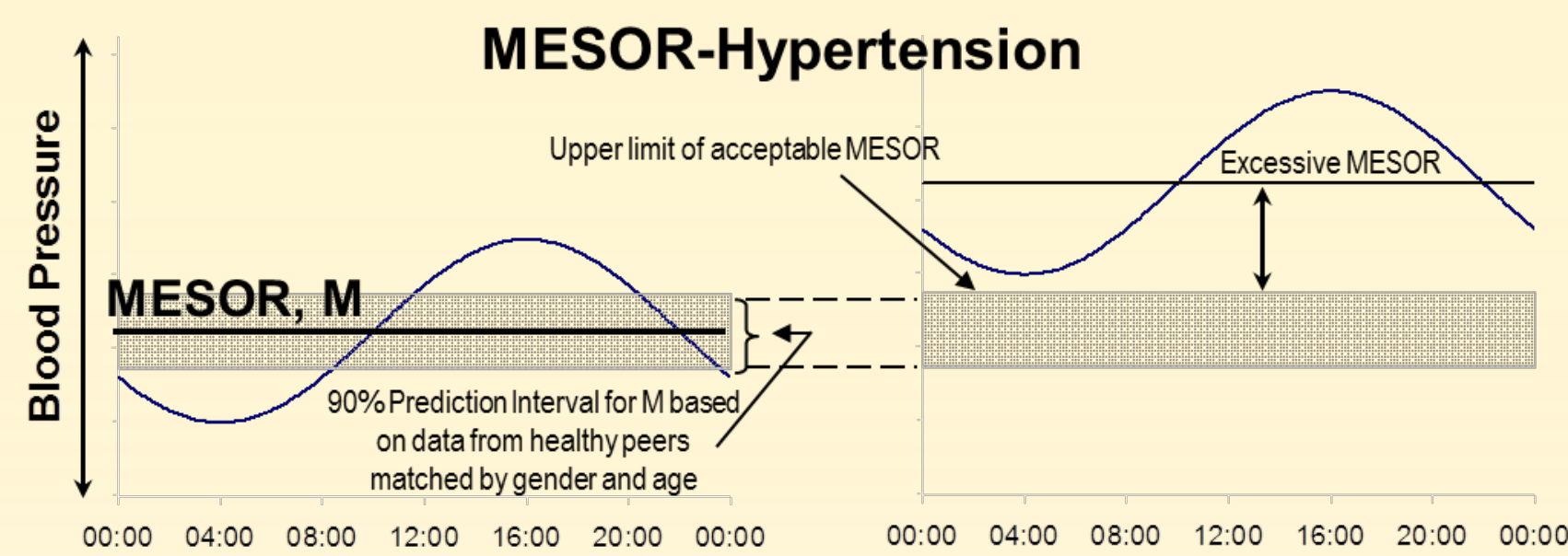
G Cornelissen<sup>1</sup>, C Lee Gierke<sup>1</sup>, J Siegelova<sup>2</sup>, Y Watanabe<sup>3</sup>, K Otsuka<sup>3</sup>

<sup>1</sup>University of Minnesota, Minneapolis, MN, USA; <sup>2</sup>Masaryk University, Brno, Czech Republic;

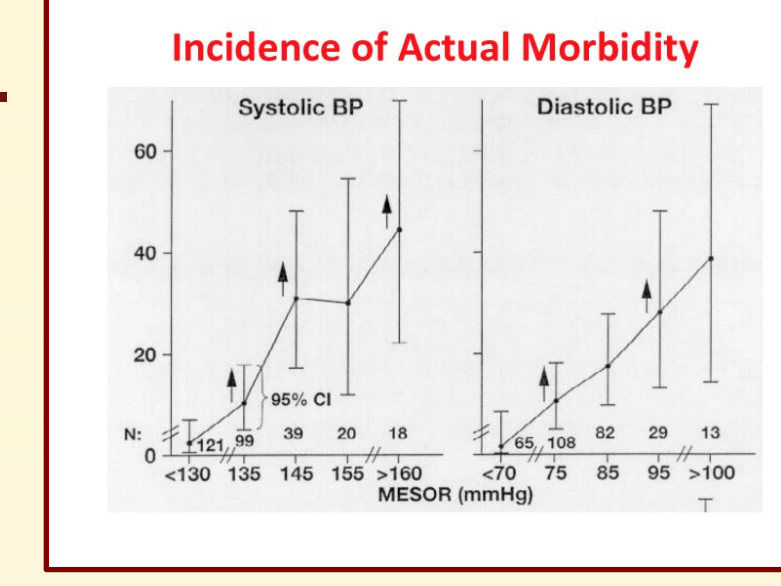
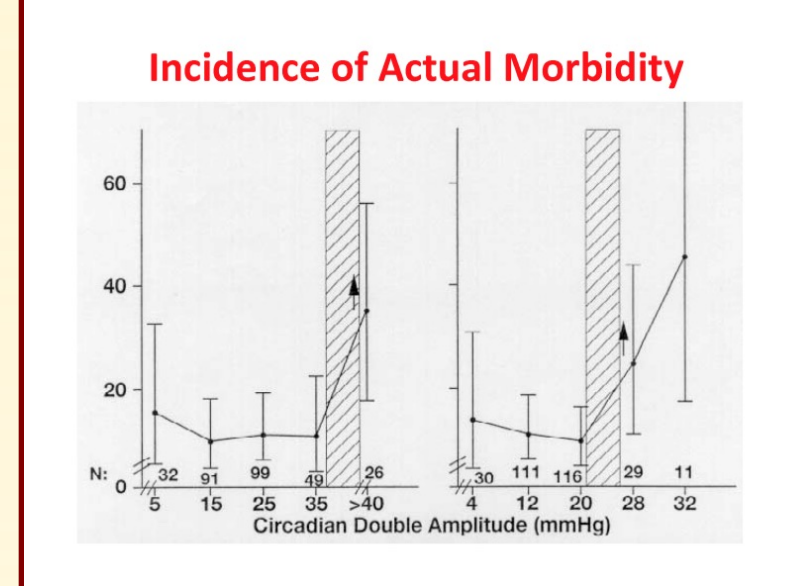
<sup>3</sup>Women's Medical University, Tokyo, Japan

## Vascular Variability Disorders (VVDs)

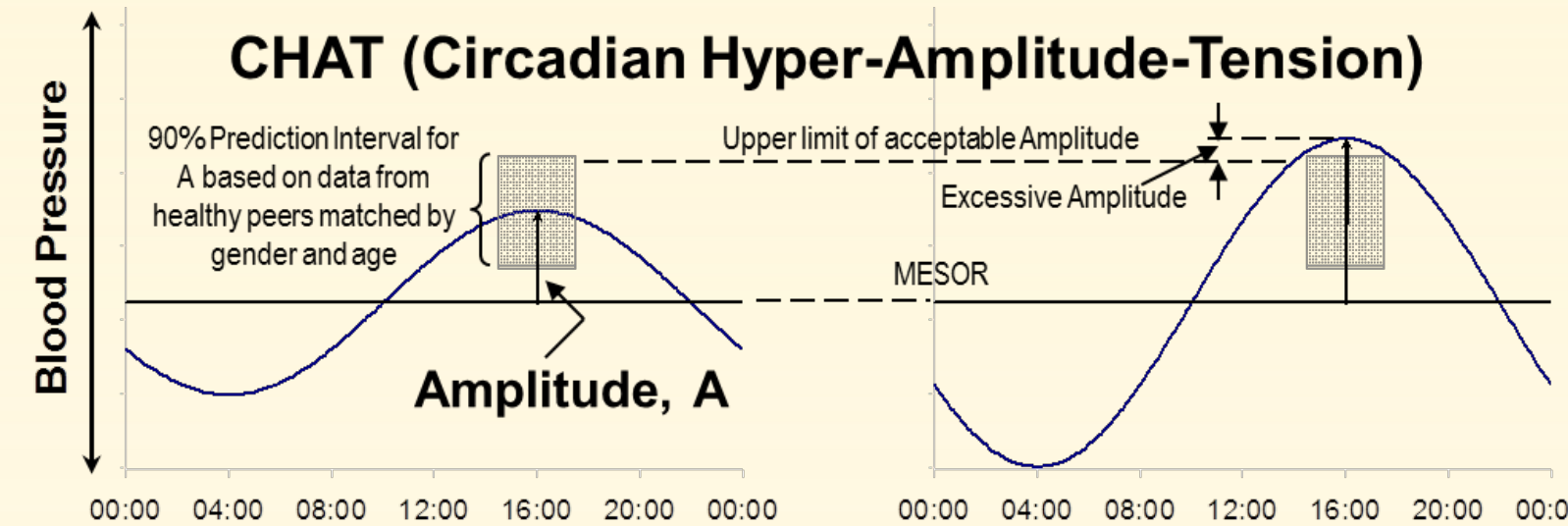
In addition to an elevated blood pressure (BP), other patterns of alteration in the circadian variation of BP and heart rate (HR) increase stroke risk. These VVDs are illustrated below and opposite.



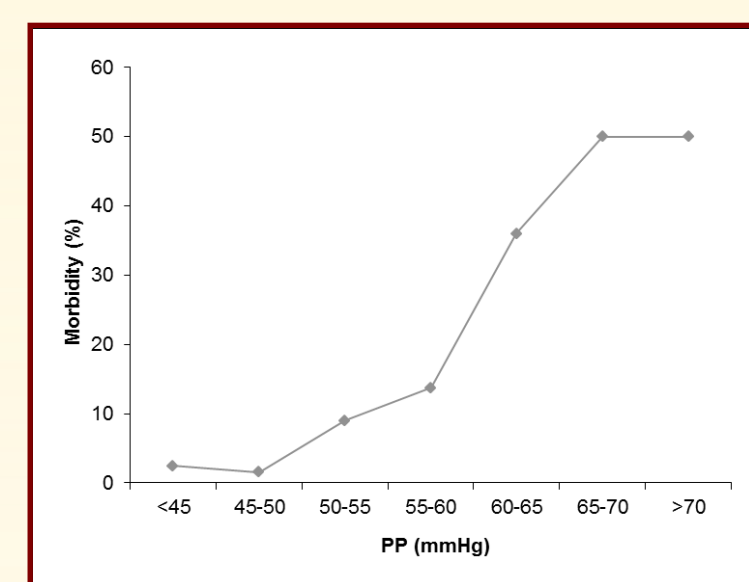
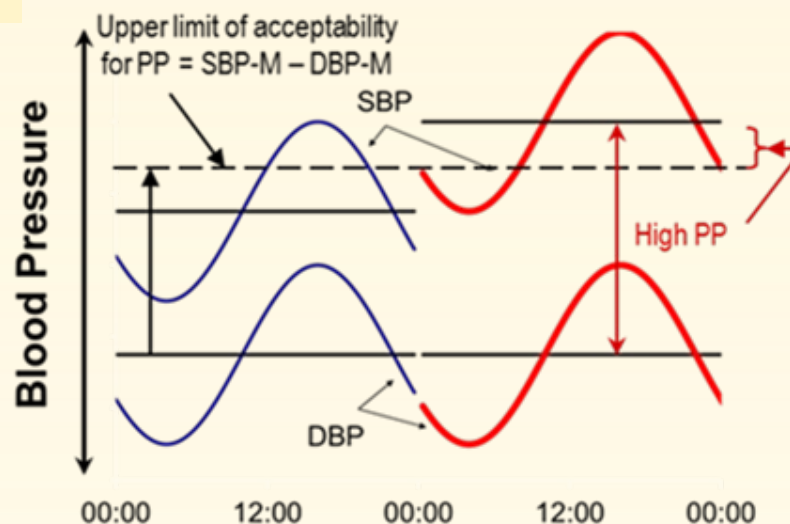
Rhythm-adjusted BP mean is too high



CHAT: Circadian BP overswing



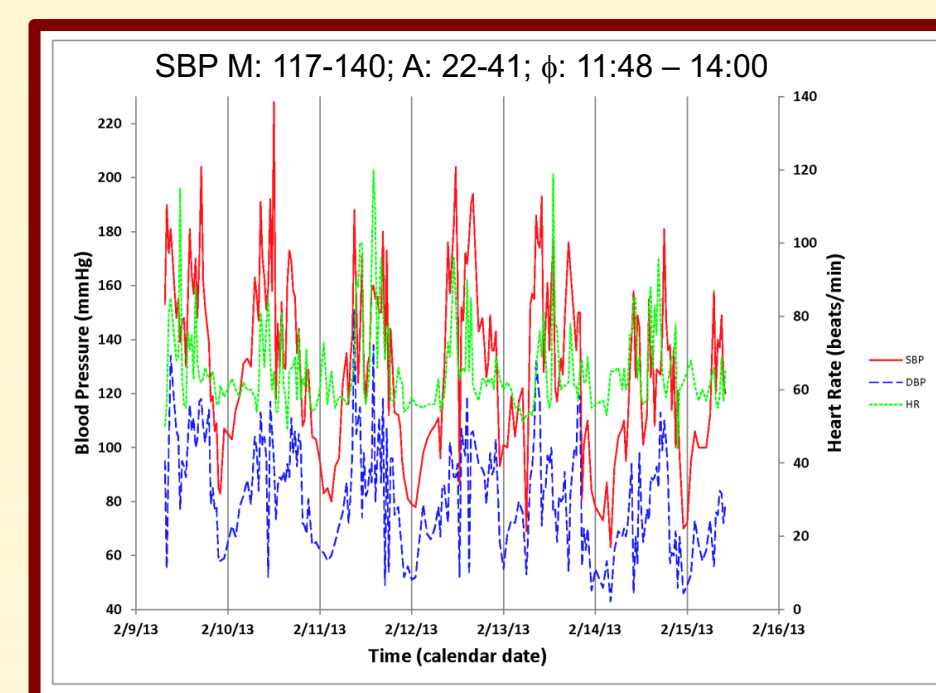
## Excessive Pulse Pressure



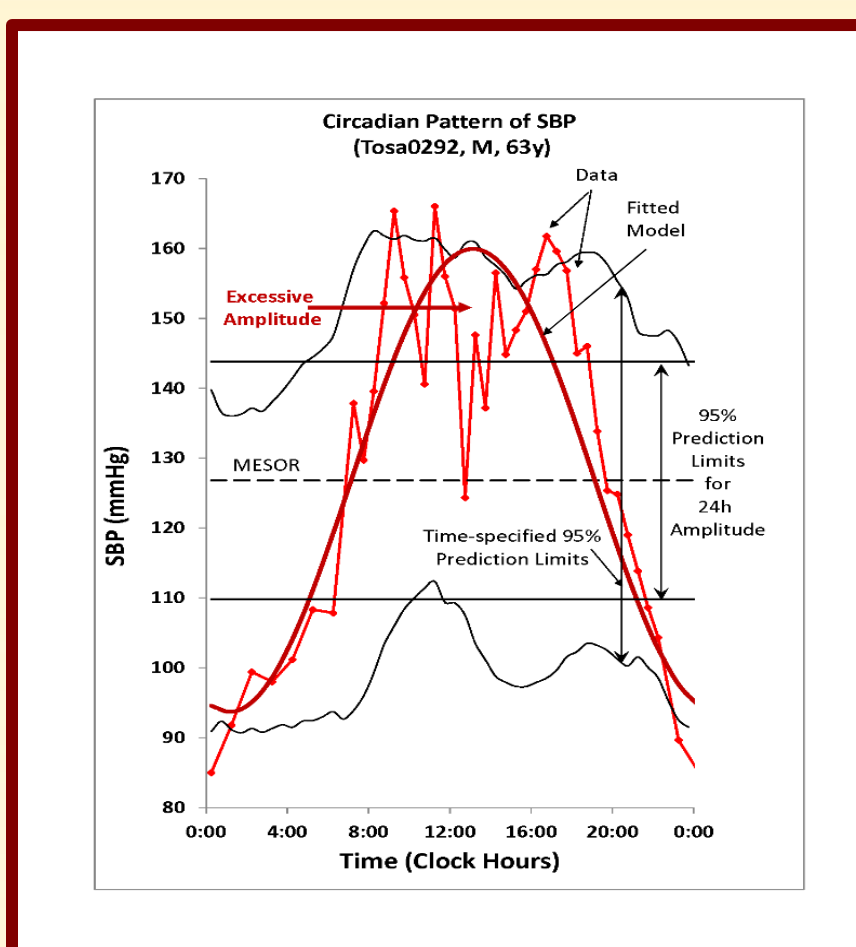
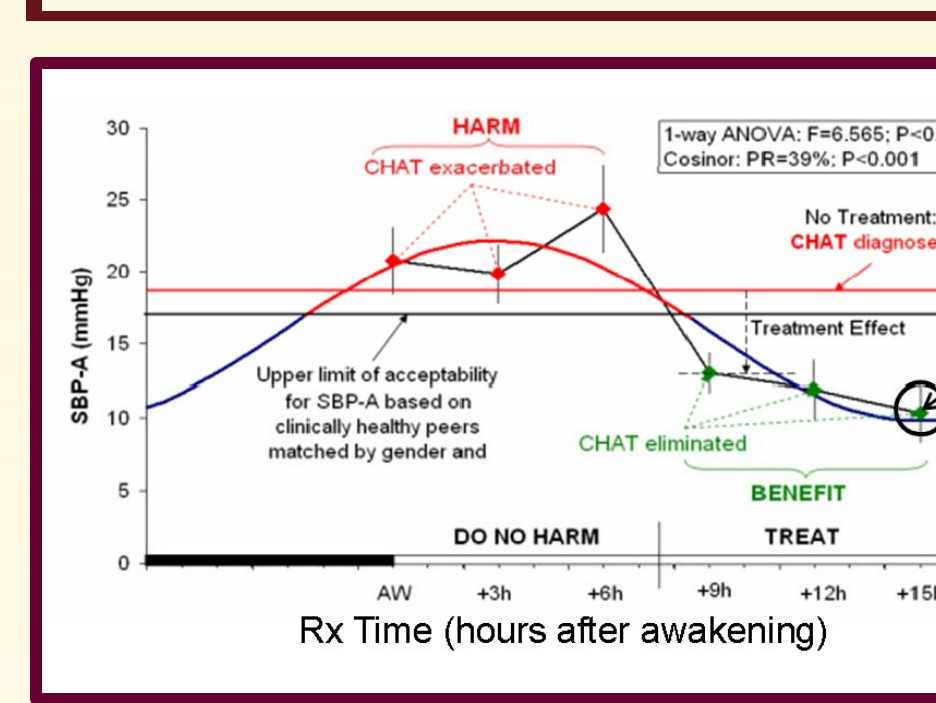
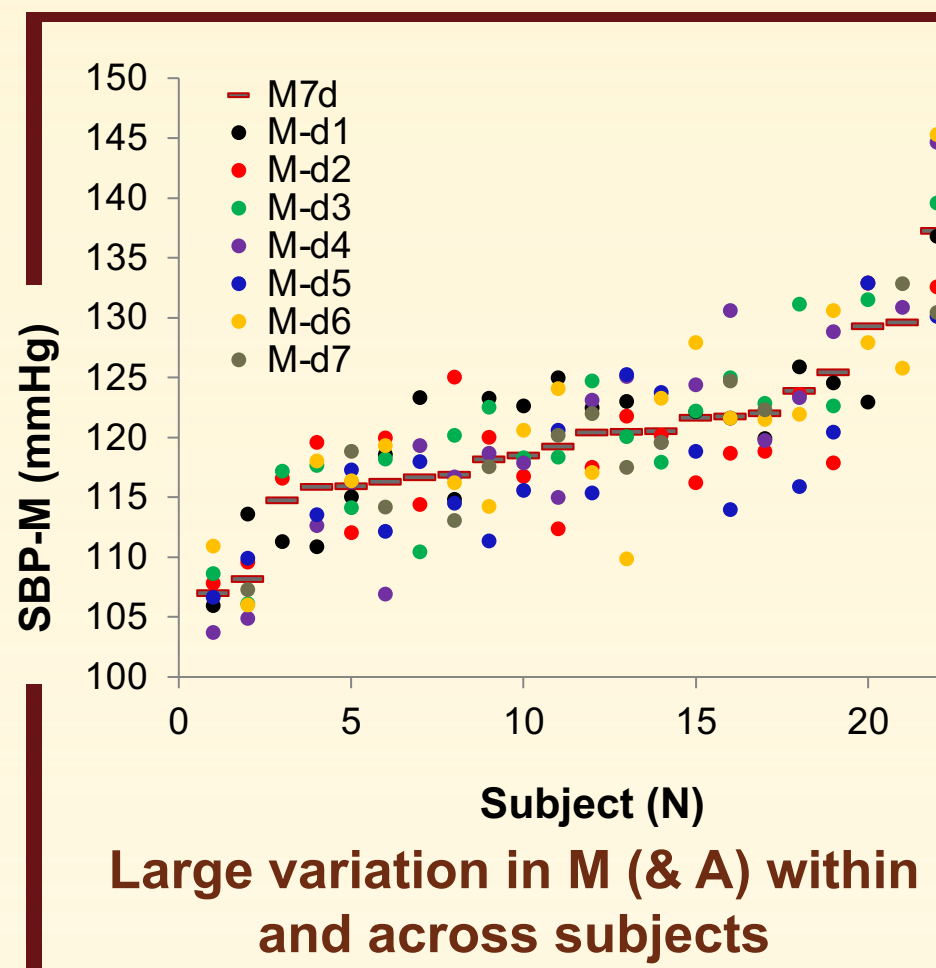
EPP: Difference between SBP and DBP is too large

## Introduction

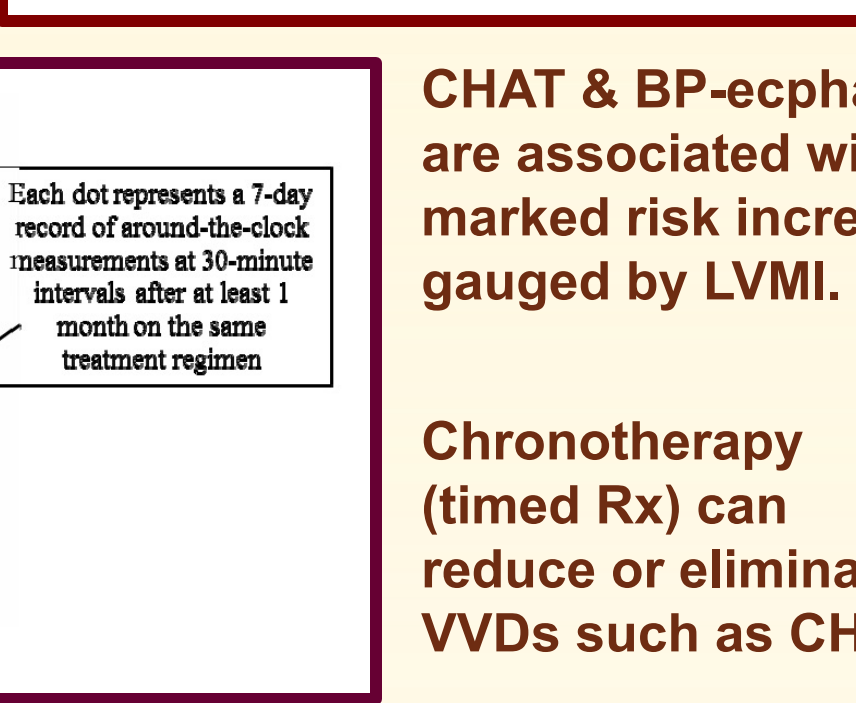
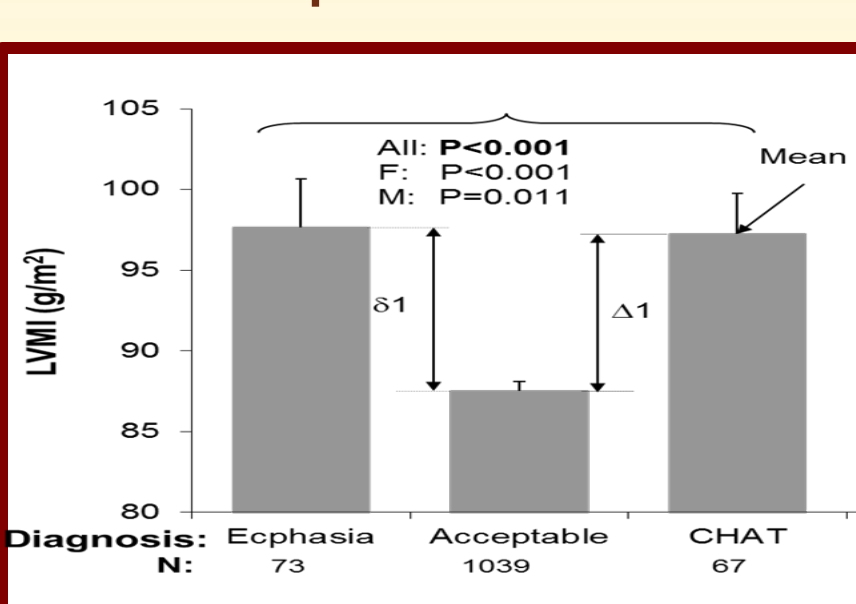
The circadian rhythm characteristics of BP vary greatly from day to day. Variation is determined by genetics, epigenetics, responses to environmental stimuli, aging and cardiovascular disease state. Assessing circadian rhythm parameters (MESOR, amplitude, phase) in the light of time-specified reference limits qualified by gender and age identifies vascular variability disorders (VVDs).



A week of BP readings, every 30 min



Circadian amplitude exceeds threshold while 24-hour average is within acceptable limits.

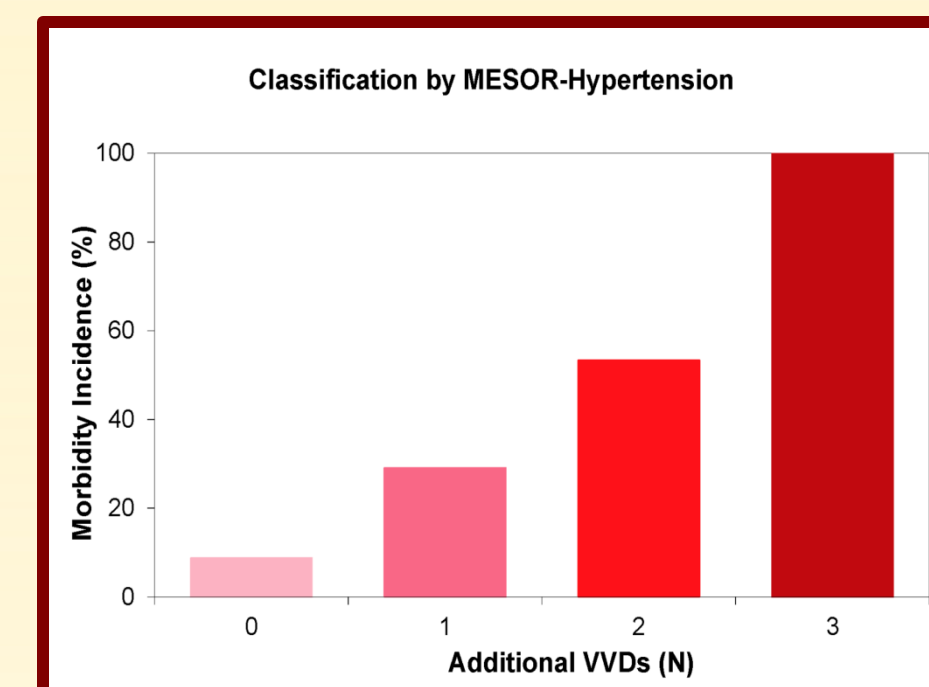


CHAT & BP-ectasia are associated with marked risk increase gauged by LVMI.

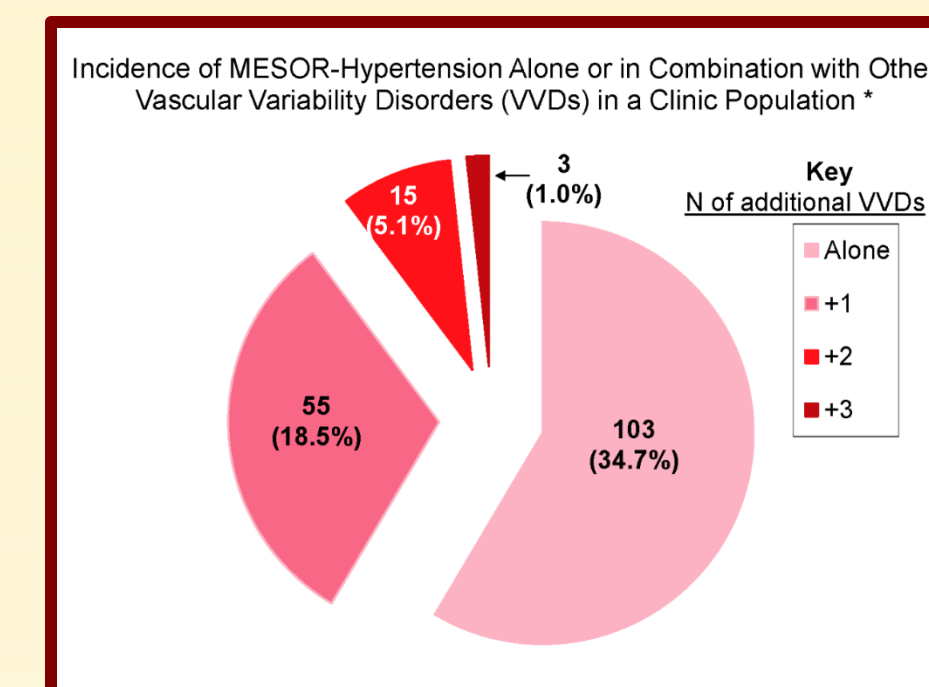
Chronotherapy (timed Rx) can reduce or eliminate VVDs such as CHAT.

## Clinical Relevance

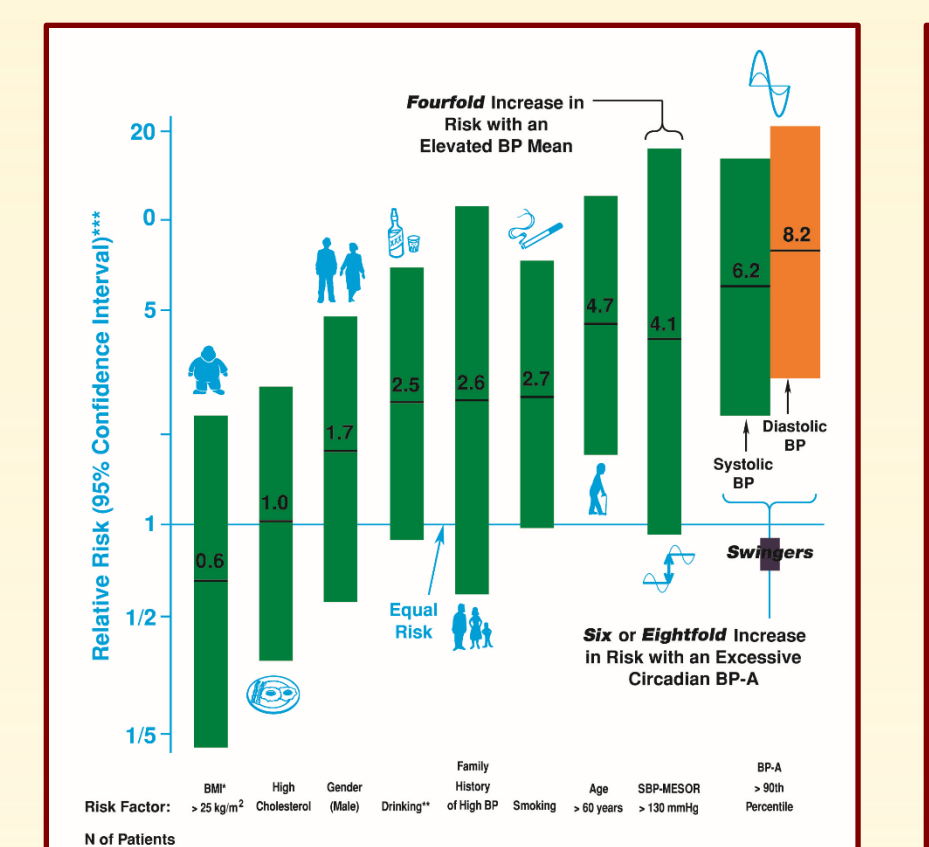
VVDs are associated with a large increase in cardiovascular disease risk in several prospective outcome studies. In particular, CHAT significantly elevates stroke risk. Day-to-day variability in M, A & phi requires 7d/24h ABPM to reach a reliable diagnosis.



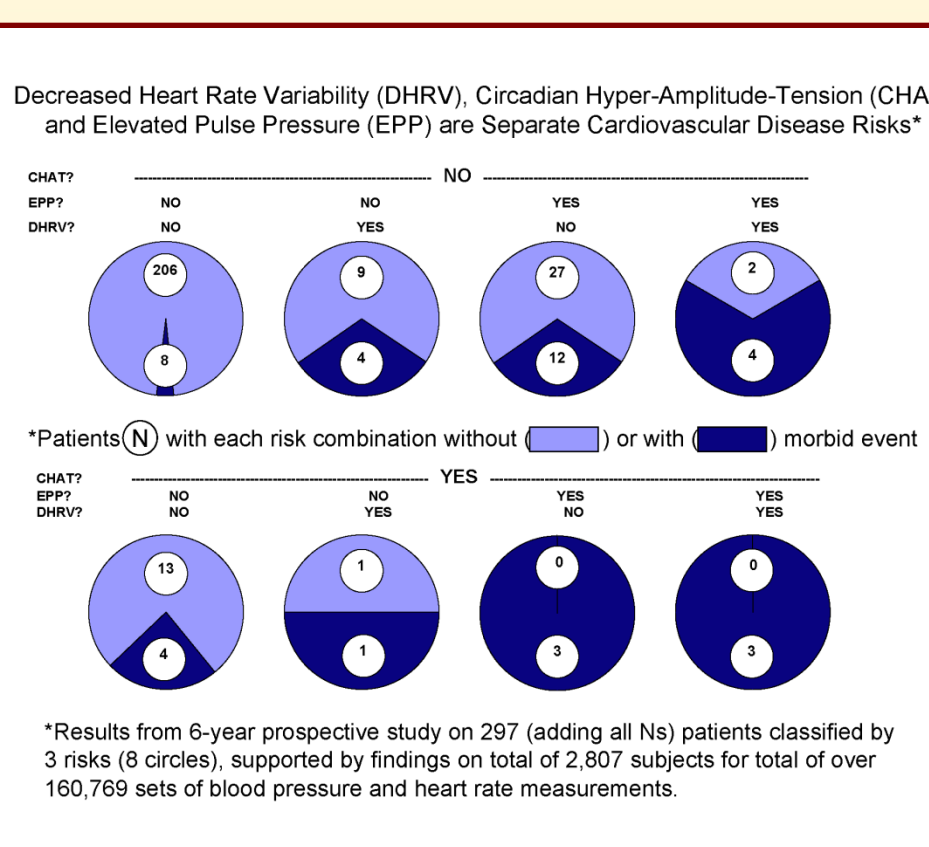
With each additional VVD present, CVD risk is increased.



VVDs other than MH affect many, but are not screened for today.



CHAT carries a higher risk of morbidity than high BP.



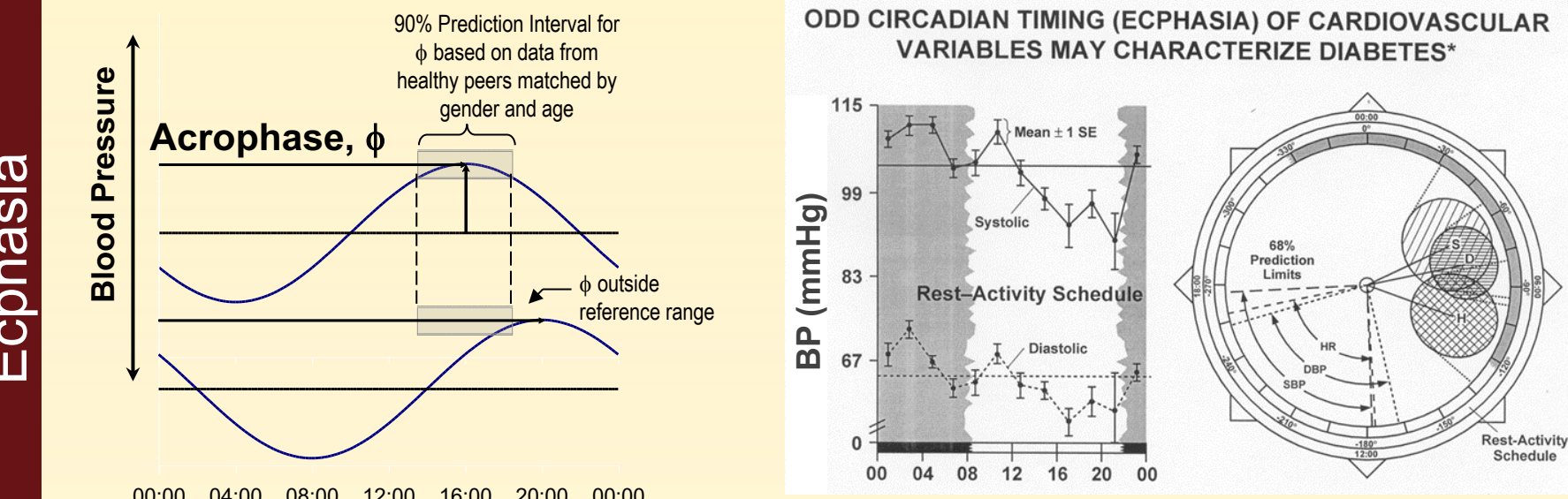
VVDs are mostly additive and independent. Note all risks are higher in combination with CHAT.

## Conclusions

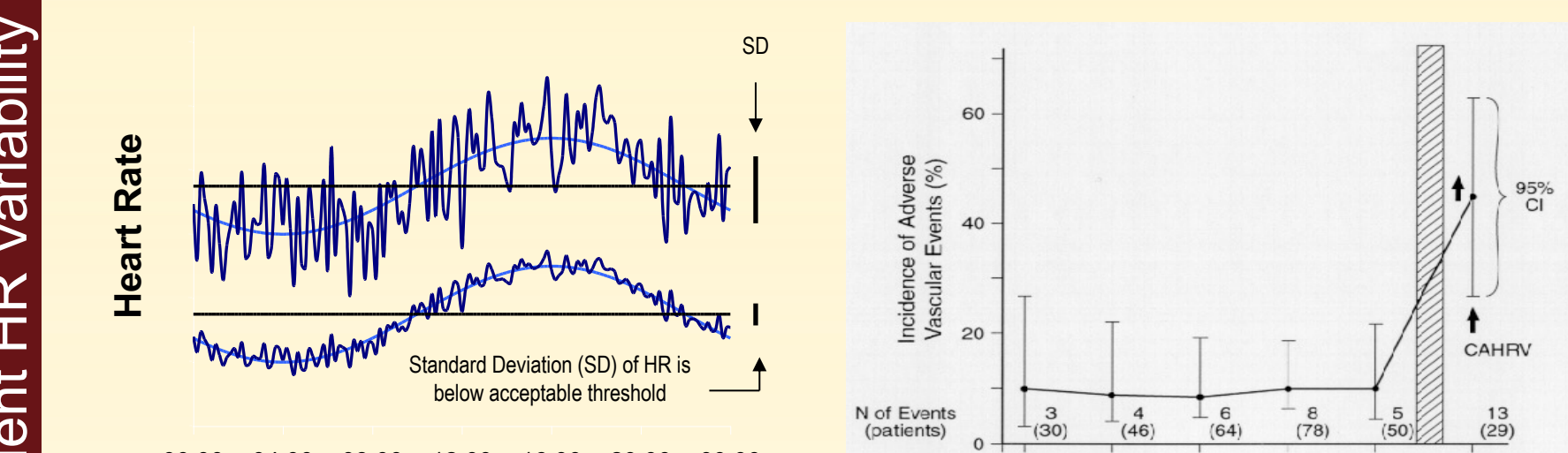
BP monitoring provides for health surveillance and treatment optimization by timing. Screening for alteration of circadian characteristics other than the average BP yields a refined diagnosis aimed at both primary and secondary prevention, stroke in particular.

This research was supported by the Halberg Chronobiology Fund

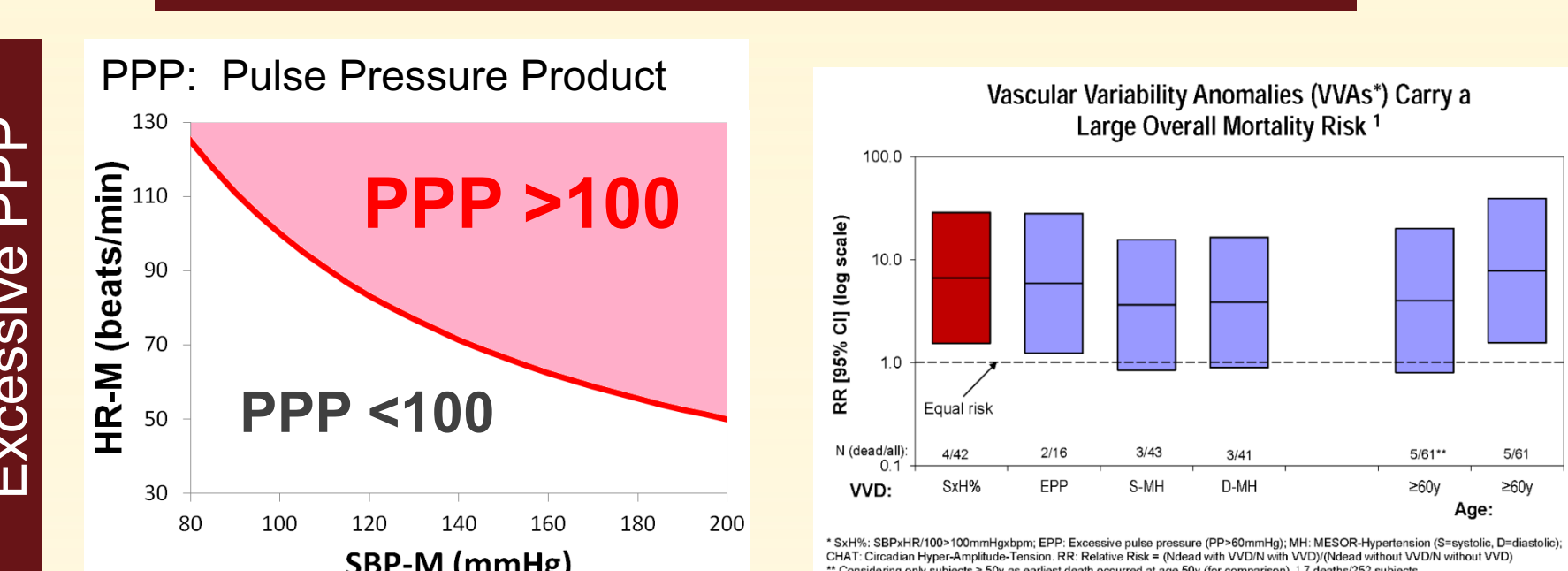
## Vascular Variability Disorders (VVDs)



Odd BP timing occurs in NIDDM complicated by AND (DHRV).



DRHV, gauged by HR-SD (like BP-A) relates nonlinearly to risk.



Excessive SBPxHR had the highest risk of mortality in Brno DB.

## Future Directions

Chronomic analysis identifies VVDs, allowing timely application of chronotherapy to maintain health, avoiding costly rehabilitation. Screening for VVDs by chronobiologic interpretation of 7-day/24-hour ABPM aiming at primary prevention awaits large-scale trials and introduction in routine clinical practice.

## Reference

- Otsuka K, Cornelissen G, Halberg F. Chronomics and Continuous Ambulatory Blood Pressure Monitoring. Vascular Chronomics: From 7-Day/24-Hour to Lifelong Monitoring. Springer 2016..