

**An Empirical Test of a Vagal Subtype of Major Depression**  
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Vagally mediated heart period variability (V-HPV) has been found to be lower in depressed samples, although, not all studies replicate this finding. Given the heterogeneity of major depression, it was proposed that V-HPV might covary specifically with a particular subset of the symptoms of major depression. Using Polyvagal Theory as a guide a Vagal Subtype was defined and tested in a large sample (n=90) diagnosed with Major Depression. Little empirical support was found to suggest that V-HPV was related to the Vagal Subtype. Factor-analytically derived symptom scales were also unrelated to V-HPV. Change in two of these scales over time, however, covaried with change in V-HPV. Doussard-Roosevelt and Porges' (1999) conceptualization of the vagus nerve as a two-tiered system is used as a guide to interpret the findings.

#### Introduction

- ❑ Research has implicated the parasympathetic nervous system in playing a role in Major Depression
  - ❑ Some studies have found *lower* levels of vagally-mediated heart period variability (V-HPV) in clinically depressed patients compared to controls (Roose, et al, 1989; Rechlin et al, 1995; Dalack & Roose, 1990; Rechlin et al, 1994).
  - ❑ Other researchers have found no such differences in V-HPV (Rechlin, 1994; Moser et al, 1998; Lehofer et al, 1997).
  - ❑ This inconsistency in the literature is not surprising as Major Depression is a heterogeneous disorder.
- ❑ The following hypotheses were tested:
  - ❑ *Some* but not all cases of Major Depression will be related to lower V-HPV—a “Vagal Subtype”. The Vagal Subtype includes those cases with the symptoms of sadness, attention difficulties, psychomotor agitation, and insomnia.
  - ❑ As those symptoms decrease across 16 weeks of treatment, V-HPV would increase.

#### Why Select *Those* Symptoms?

- ❑ **Sadness should be related to lower V-HPV**
  - ❑ Polyvagal Theory (Porges, 1995) predicts V-HPV would be lower for negative emotions and higher for positive emotions
    - ❑ Rechlin et al (1995) found lower V-HPV when sadness was greatest in the morning and higher V-HPV when sadness was lower in a sample of depressed subjects with diurnal variation of mood.
- ❑ **Attention Difficulties should be related to lower V-HPV**
  - ❑ Two Component Model of Attention (Porges, 1976, 1980, 1992) partials attention into 2 parts—reactive and sustained.
    - ❑ Reactive: V-HPV increases during the orienting reflex to allow optimal perception of stimulus.
    - ❑ Sustained: V-HPV changes in response to the type of stimulus. V-HPV decreases with intense or important, stimuli and increases with novel or mild stimuli
      - ❑ Higher levels of V-HPV related to greater *capacity* to sustain attention (Porges, 1972, 1973; Huffman et al, 1988)
- ❑ **Psychomotor Agitation should be related to lower V-HPV**
  - ❑ Polyvagal Vagal Theory (Porges, 1995) purports that the removal of the vagus nerve's inhibition of the heart rate for short periods of time promotes metabolic output to foster locomotion.
    - ❑ Porges (1976) proposed different patterns of autonomic activation produce different types of behavioral responses resulting in different psychopathology:
      - ❑ Chronic sympathetic activation → general reflexive behaviors as seen in hyperactive children (Porges et al, 1975)
      - ❑ Chronic parasympathetic activation → inhibition of reflexive behaviors and more fluidity in voluntary responsiveness as seen in psychopaths (Broverman et al, 1968; Quay, 1976)
  - ❑ Researchers debate whether anxiety is related to psychomotor agitation. For this study, it is assumed that they are related.
    - ❑ Low V-HPV has been related to anxiety and panic symptoms in several studies (Watkins et al, 1998; Friedman and Thayer, 1998; Lyonsfields et al., 1995)

#### ❑ **Insomnia should be related to lower V-HPV in depression**

- ❑ V-HPV is predominant during sleep (Vanoli et al, 1995) and greatest during non-REM sleep in normals (Elsenbruch et al, 1999)
- ❑ Bonnet and Arand (1998) found insomnia was related to decreased V-HPV

#### Methods

##### ❑ **Subjects**

- ❑ 90 physically healthy subjects (65 females) diagnosed with Major Depression based on the DSM-IV
- ❑ Between 18 and 65 years of age
- ❑ No comorbid diagnoses
- ❑ Hamilton scores  $\geq 14$  (17-item version)

##### ❑ **Study Design**

- ❑ Random assignment to acupuncture for specific depression symptoms (SPEC), acupuncture for non-depression symptoms (NSPEC), or waitlist (WAIT) for 8 weeks; everyone then received SPEC for another 8 weeks.
- ❑ Subjects assessed every two months (Pre-, Mid-, and Post-treatment):
  - ❑ HRSD and Major Depression module of SCID
  - ❑ Beck Depression Inventory (BDI), Medical Outcomes Study 36-item Short Form (MOS-36), Response Styles Questionnaire (RSQ)
  - ❑ Five-minute resting baseline recording of heart rate
    - ❑ EKG electrodes placed on right and left arm just below the elbow
    - ❑ Ground placed below wrist on right arm.
    - ❑ Signals sampled at 1024 Hz

##### ❑ **Measures**

- ❑ Symptom measures for sadness, attention difficulties, insomnia, and psychomotor agitation were derived from items from the HRSD, SCID, BDI, MOS-36, and RSQ. The standardized items were averaged to form composite scores.
- ❑ V-HPV
  - ❑ Interbeat interval (IBI) series hand corrected for artifacts.
  - ❑ IBI series were passed through an optimal finite impulse response digital filter with a .12-.40 Hz bandpass, sampled at 10Hz.
  - ❑ Natural log transformed variance in this .12-.40 Hz signal was extracted as the index of V-HPV (Allen, 2002; CMET software available at <http://apsychoserver.psych.arizona.edu>)

#### Results

- ❑ **Internal Reliability of Symptom Measures** ranged from fair to high across three time points (.65 to .91) except for the pre-treatment measure of sadness (.42), which was due to a restricted range.

**Was V-HPV related to symptoms of the “Vagal Subtype”?**

(sadness, attention difficulties, psychomotor agitation, and insomnia)

**No.** Zero order correlations (after controlling for sex, age, and their interaction) indicated no relationships at any time points (all correlations were  $< .15$  in magnitude).

**Was Change in V-HPV related to Change in symptoms of the “Vagal Subtype”** (sadness, attention difficulties, psychomotor agitation, and insomnia)

**No.** Meta-Analytic Growth Curve Analyses were used to derive a slope for each symptom and V-HPV across the 16 weeks. Zero order correlations indicated no relationships between V-HPV with any of the “vagal symptoms”. (all correlations were  $< .18$  in magnitude)

**Is V-HPV related to other aspects of depressive symptomatology?**

An Exploratory Factor Analysis (EFA) was conducted on the dataset using all of the HRSD and BDI items.

Maximum likelihood method for extraction.

Scree plot suggested 5 factors

Direct Quartimin Oblique rotation extracted 5 factors, accounting for 36% of the variance.

Items with factor loadings greater than .3 were retained for each scale. Those loading on multiple factors remained on the factor with which it was judged to have a better conceptual fit (See Table 1).

Equally weighted scale scores were created instead of sample-optimized factor scores.

Internal consistency ranged from poor to excellent across the three time points (range .33-.91, median = .68)

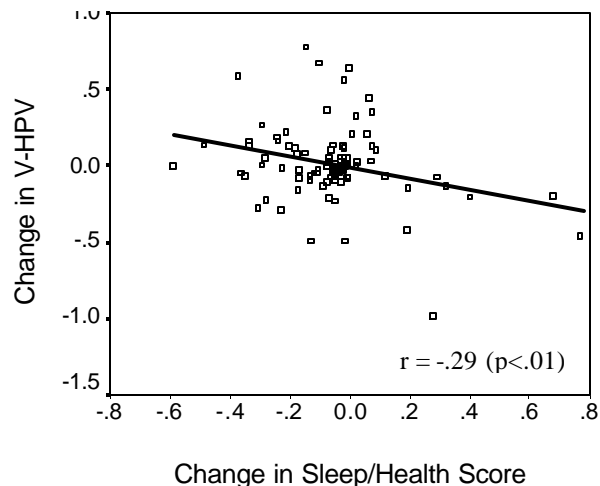
**Did EFA-Derived Symptoms relate to V-HPV?**

**No.** Zero order correlations (after controlling for sex, age, and their interaction) indicated no relationships at any time points.

**Was Change in V-HPV related to Change in EFA-Derived symptom scales of the “Vagal Subtype”?**

**YES!** Meta-Analytic Growth Curve Analyses were used to derive a slope for each symptom and V-HPV across the 16 weeks.

Zero order correlations indicated increases in V-HPV was related to decreases in the Anorexic Scale and decreases in the Sleep/Health Concern Scale. Thus greater increases in V-HPV accompanied fewer reports of weight loss and lack of appetite and fewer concerns about one’s health, decreased early morning insomnia, and decreased sadness upon awakening .



**Discussion**

This study provides no support for a Vagal Subtype as defined by the depressive symptoms of sadness, insomnia, attention difficulties, anxiety, and psychomotor agitation.

Increases in V-HPV were related to increases in weight and appetite as well as decreases in health concerns, sadness upon awakening and morning sadness.

These measures tap into the homeostatic functions of the vagus nerve that Doussard-Roosevelt and Porges (1999) contend are reflected in resting levels of V-HPV.

Doussard-Roosevelt and Porges (1999) also propose the 2nd tier functions of the vagus nerve (motion, attention, emotion modulation) are elicited when an organism responds to the environment. Further, these functions can only be measured by recording heart rate while an organism is stressed.

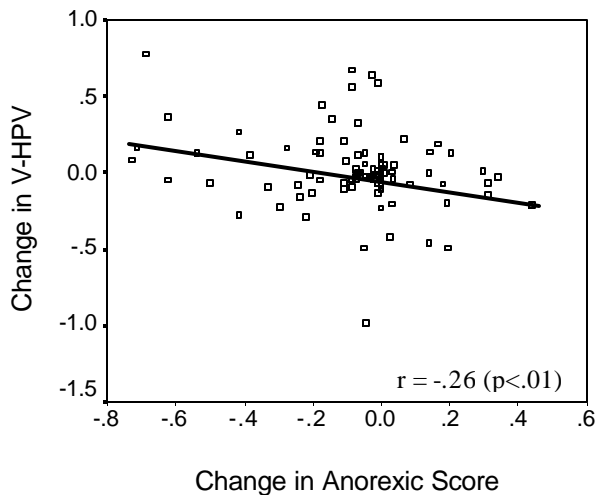
The current study only measured resting baseline V-HPV.

Future research might profitably observe how V-HPV modulation is related to the proposed Vagal Subtype of depression.

Limitations of this study:

This study relied solely on subjective retrospective self report measures. Perhaps performance, polysomnographic, physiological, or observational measures of symptoms would produce different results and possibly identify a Vagal Subtype of depression.

The measurement of V-HPV did not control for respiration. On the other hand, all IBI series were hand edited for aberrant values that might create artifacts. Further, no task related stressors were present that might be expected to influence respiration rates.



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**Table 1. Factor Loadings from Exploratory Factor Analysis**

Variable	Cognitive	Anorexic	Sleep/Health	Vegetative	Anxiety
BDI Items:					
Sadness	0.35			0.32	
Discouragement	0.60				
Failure	0.59				
Dissatisfaction	0.35			0.45	
Guilt	0.43				
Punished	0.53		0.54		
Disappointed with self	0.64				
Self-critical	0.37				0.42
Suicidal	0.36				
Crying					
Irritable					
Lack of interest in others	0.41			0.41	0.30
Indecisive	0.32			0.34	0.35
Unattractive	0.40			0.50	
Unmotivated				0.57	
Insomnia			0.33	0.30	
Tired				0.55	
Loss of appetite		0.31		0.58	0.37
Loss of weight		0.52			
Health concerns			0.57	0.32	
Disinterest in sex				0.46	
HRSD Items:					
Depressed mood	0.39				
Pathological guilt	0.62		0.31		
Suicidal thinking	0.51				
Insomnia-Early				0.38	
Insomnia-Middle					
Insomnia-Late			0.37		
Hyposomnia					
Loss of interest/pleasure				0.32	
Psychomotor retardation					
Psychomotor agitation					
Psychic Anxiety					0.62
Somatic Anxiety					0.48
Appetite Decrease		0.78			
Loss of energy		-0.36		0.47	
Loss of libido				0.34	
Somatic concerns			0.45		
Loss of weight		0.53			
Weight gain		-0.53			
Appetite increase		-0.66			0.44
Carbohydrate craving		-0.30			0.30
Lack of insight			0.33		
Diurnal variation of mood			0.41		
Worse mood upon awakening			0.36		
Worse mood before going to sleep					
Depersonalization and derealization					
Paranoid symptoms					
Obsessive and compulsive symptoms					0.34
Helplessness	0.48				
Hopelessness	0.55				
Worthlessness	0.53				

Note: Only loadings with absolute values > .29 are displayed