Anger, Hostility, and Re-hospitalizations in Patients with Heart Failure: A Structural Equation Modeling Assessment

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Introduction to the Problem: Definition of Heart Failure

- Heart failure (also known as congestive heart failure):
  - Heart's inability to pump enough blood to meet the body's demands
- HF may be caused by several underlying conditions (most commonly coronary heart disease and hypertension)
- Symptoms:
  - Shortness of breath
  - Swelling in feet or ankles
  - Reduced ability to exercise
  - Fatigue

Introduction to the Problem: Impact on Health Care

- ~670,000 Americans diagnosed each year
- High mortality rate
- Costs $39.2 billion a year in health care
  - Most costs due to re-hospitalizations
  - ≥50% of patients readmitted within 6 months
- Multiple comorbidities
  - ~63% of re-hospitalizations in patients with HF, are due to causes other than HF

  (e.g., pneumonia, diabetes, COPD, cancer)

Anger/Hostility

- Often treated as constellation of traits
  - *Anger* considered an emotion; dimensions include: directionality, state vs. trait, and ability to control
  - *Hostility* considered a set of attitudes, divided into separate components including: cynicism, aggressiveness, etc.
- Meta-analysis of 25 studies (Chida & Steptoe, 2009):
  - Positive associations between anger, hostility, and coronary heart disease in healthy and high risk populations
  - Effects of anger and hostility greater in high risk populations
- Hostility increases risk for coronary death and nonfatal myocardial infarction
  - Hostility is also predictive of total mortality
- Role of hostility in HF and components of anger and hostility in HF patients not well understood

Study Purpose

1. Determine the components of (a) the Anger construct and (b) the Hostility construct in a HF population

2. Using that information, to assess the relationship between Hostility/Anger to hospitalizations for cardiac, non-cardiac, and all-causes

Methods

- BETRHEART
- 150 study participants recruited from HF Clinic at the University of Maryland Hospital in Baltimore, MD
- Inclusion Criteria:
  - Current diagnosis of heart failure, stable condition and >21 years

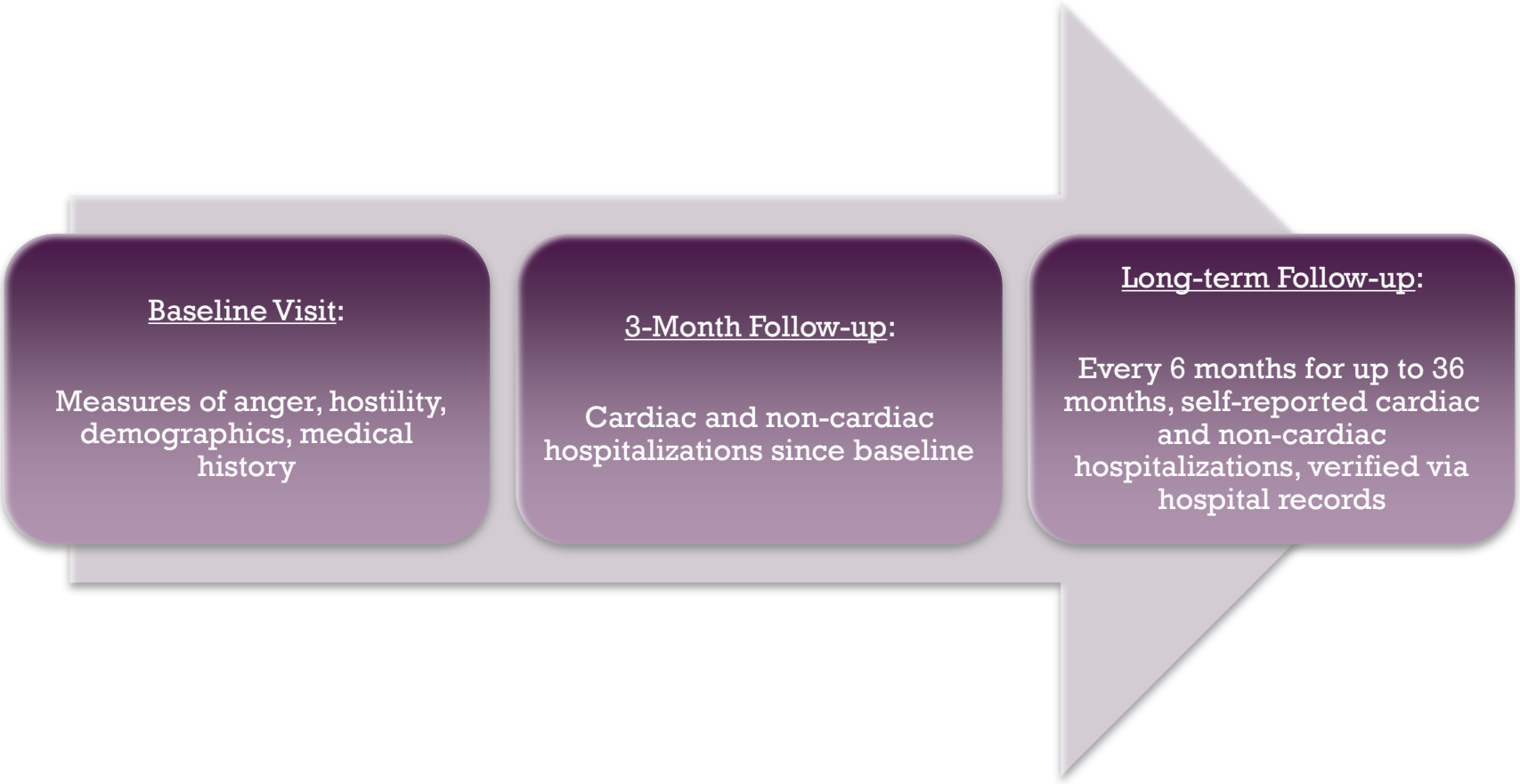
Exclusion Criteria included:

- significant valve disease as primary diagnosis
- current or recent alcohol abuse
- prior heart transplantation or left ventricular assist device
- cognitive impairments, ect.

Methods

- Anger:
  - STAXI-II (Spielberger, et. al, 1985)
  - Sub-scales: state anger, trait anger, anger expression out, anger expression in, anger control out, and anger control in
- Hostility:
  - Cook-Medley hostility scale (Cook & Medley, 1954)
  - Sub-scales: cynical hostility, hostile attributions, hostile affect, social avoidance, aggressive responding, and other
- Hospitalizations
  - **HF hospitalizations**: characterized by pump failure or fluid overload
  - **Cardiac hospitalizations**: including HF hospitalizations and all other cardiac events (e.g., angina, MI, stroke)
  - **Non-cardiac hospitalizations**: hospitalizations not cardiac in nature (e.g., GERD, other acute and chronic illness)
  - **All-cause hospitalizations**: summation of cardiac and non-cardiac hospitalizations

Longitudinal Study Design



Results

Table 1.
Sample Characteristics

		Full Sample N=150
Gender	Male	113 (75.3%)
Age (years)		56.82 ±11.43 (SD)
Race		
	African American	103 (70.5%)
	Caucasian	42 (28.8%)
	Other	(.7%)
Household Income		
	<$15,000	51 (35.2%)
	$15-30,000	39 (26.9%)
	$30-70,000	43 (29.7%)
	>$70,000	12 (8.3%)
History of Hypertension		116 (77%)
Creatinine (mg/dl)		1.38 ± .71 (SD)
Ejection fraction (%)		23.14 ± 7.48 (SD)
History of Smoking (% yes)		103 (70.5%)
Mean time in the Study (months)		24.76 ± 13.40 (SD)

Hospitalizations

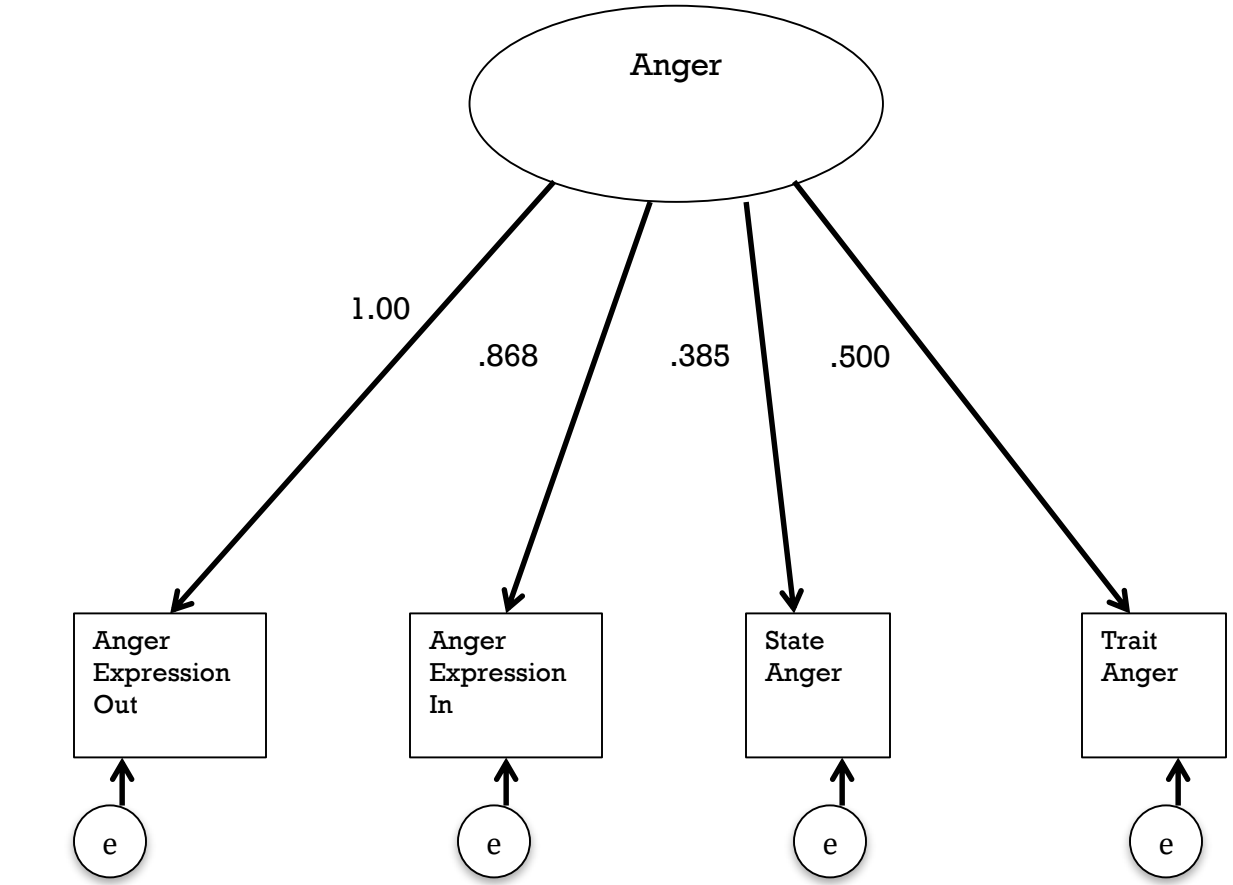
	Type of admitting diagnosis	n
Cardiac	Heart Failure	183
	Angina	35
	ICD related	32
	Hypo/hypertension	9
	Myocardial Infarction	7
	Shortness of breath	6
	Stroke	5
	Other (e.g., renal related, ischemia, revascularization, cardiomyopathy)	14
	Total:	**291**
Non-cardiac	Non-cardiac chest pain	58
	Psychiatric/Psychology	10
	Injury (e.g., broken arm)	14
	Acute Illness (e.g., pneumonia, bronchitis)	56
	Chronic Illness (e.g., cancer, COPD)	54
	Surgery (e.g., back surgery, knee replacement)	13
	Undifferentiated Symptoms	40
	Other (e.g., supratherapeutic INR, sleep study)	39
	Total:	**284**
All-Cause	Total:	**575**

Zero-order Correlations of Anger and Hostility Subcomponents

	Trait Anger	State Anger	Anger Exp In	Anger Exp Out	Cynicism	Hostile Attribution	Hostile Affect	Aggressive Resp.
Trait Anger	--	.47**	.56**	.80**	-.03	-.01	-.12	-.09
State Anger	--	--	.37**	.38**	.18**	.00	.04	.06
Anger Exp In	--	--	--	.42**	.06	.02	-.08	-.07
Anger Exp Out	--	--	--	--	.08	.00	-.11	-.06
Cynicism	--	--	--	--	--	.61**	.45**	.50**
Hostile Attribution	--	--	--	--	--	--	.49**	.42**
Hostile Affect	--	--	--	--	--	--	--	.49**
Aggressive Resp.	--	--	--	--	--	--	--	--

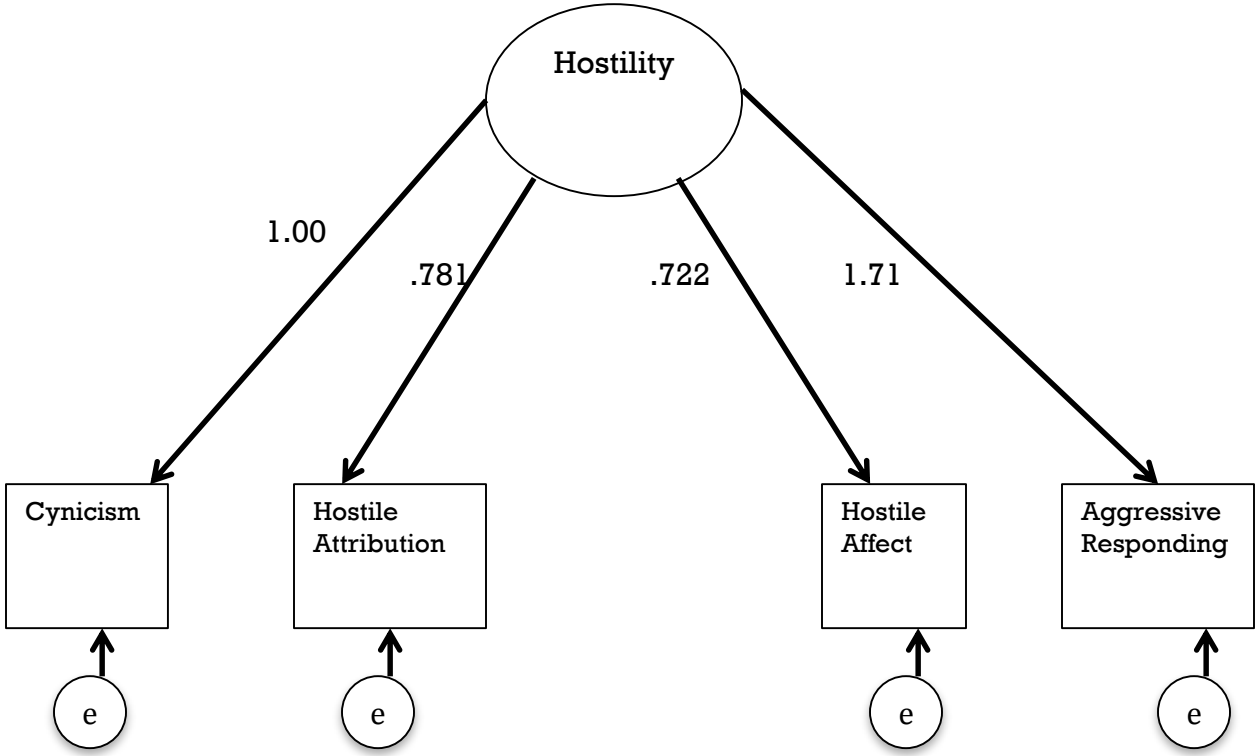
**indicates a p<.05

Measurement Model: Anger



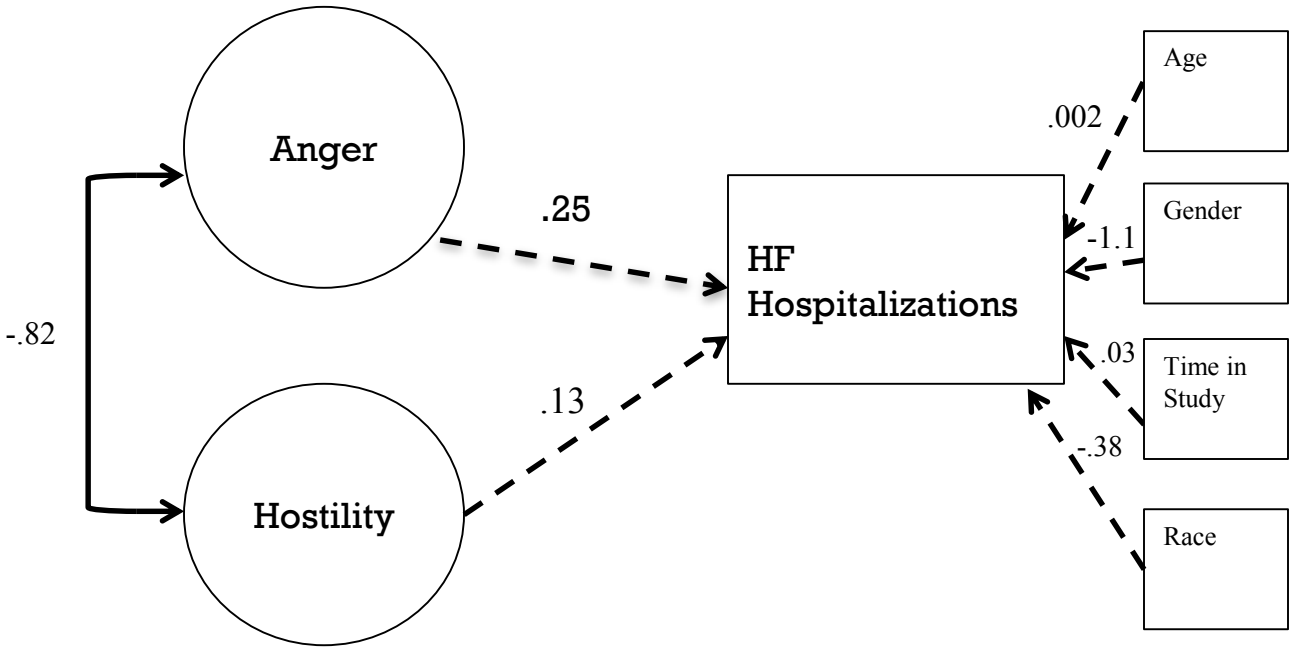
CFI=.99
TLI=.97
RMSEA=.07

Measurement Model: Hostility



CFI=1.00
TLI=1.02
RMSEA=0.0

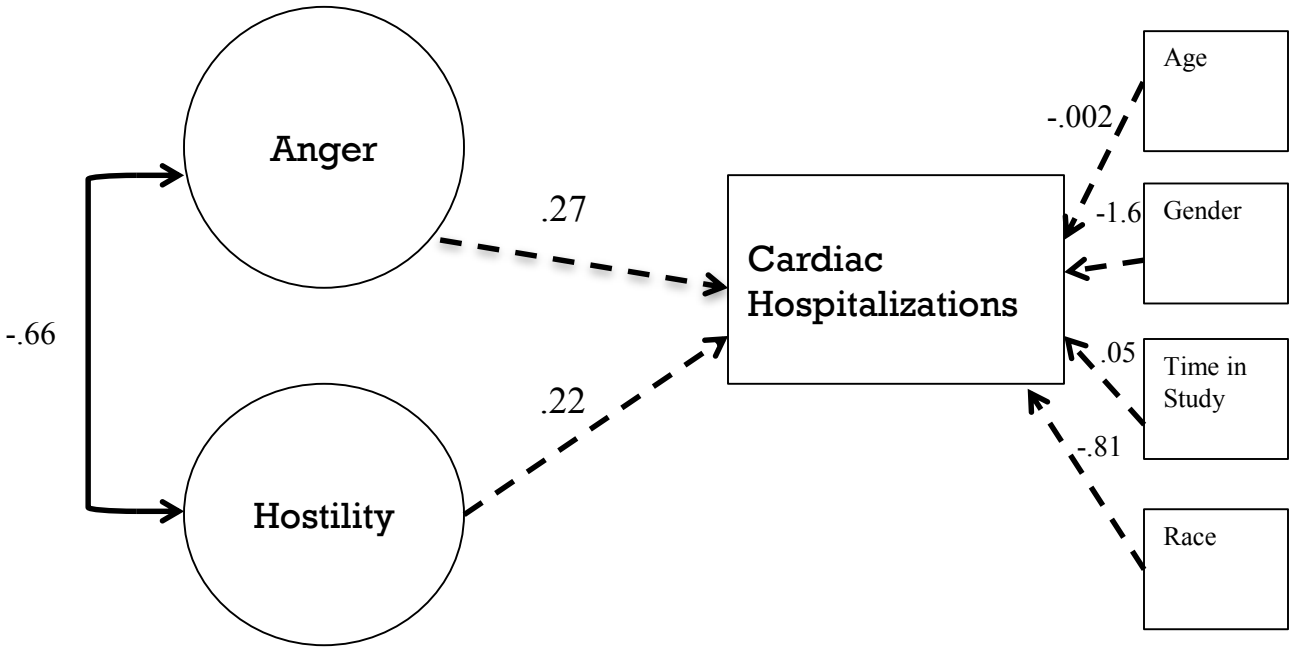
Structural Model: HF Hospitalizations*



CFI=.95
TLI=.94
RMSEA=.05

*Due to skew, hospitalizations were Windsorized

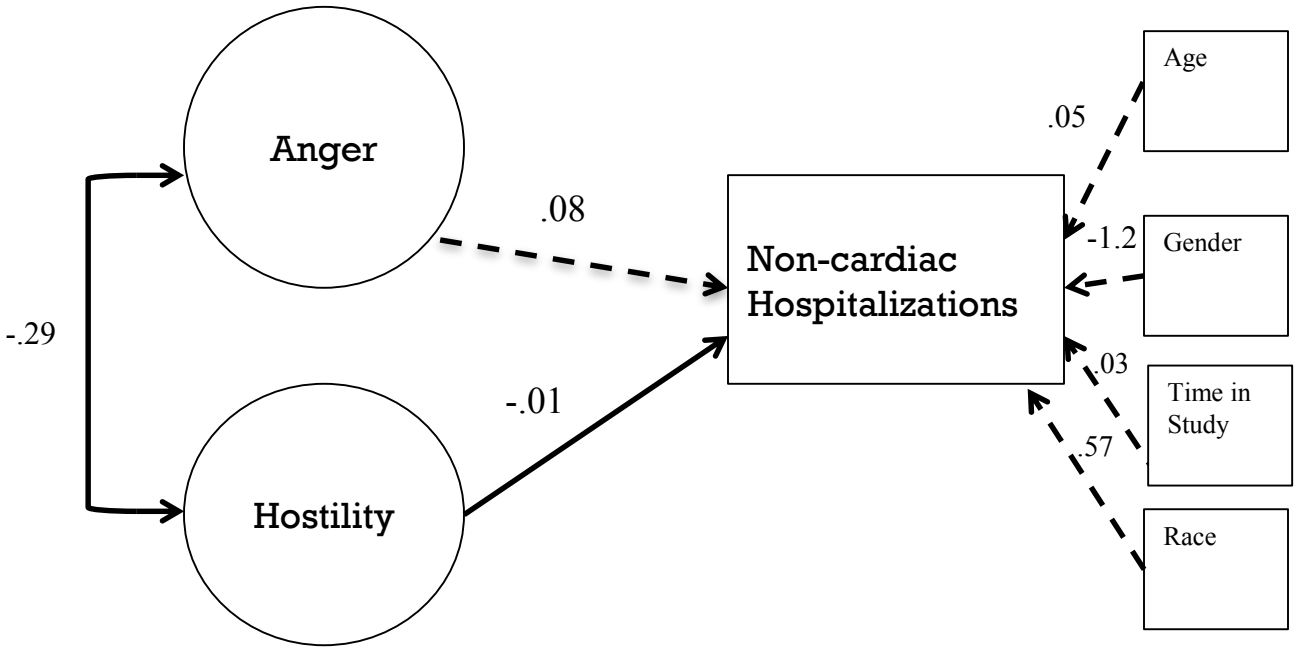
Structural Model: Cardiac Hospitalizations*



CFI=.97
TLI=.95
RMSEA=.04

*Due to skew, hospitalizations were Windsorized

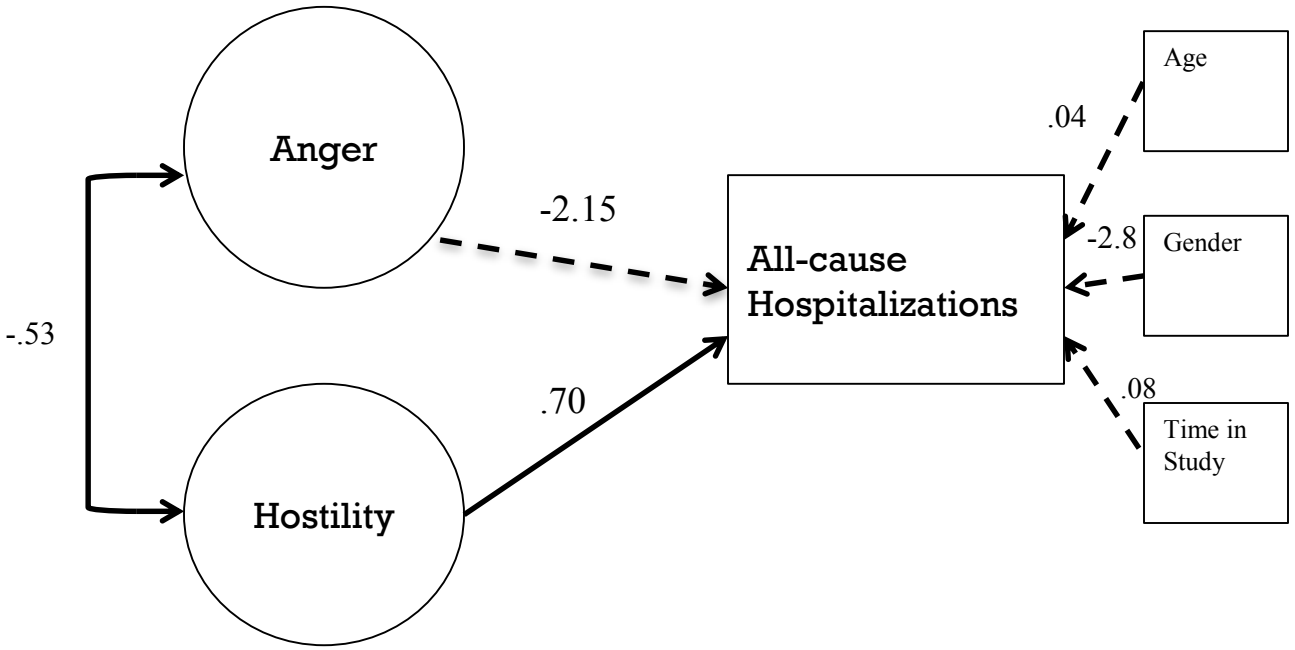
Structural Model: Non-cardiac Hospitalizations*



CFI=.99
TLI=.98
RMSEA=.02

*Due to skew, hospitalizations were Windsorized

Structural Model: All-Cause Hospitalizations*



CFI=.95
TLI=.93
RMSEA=.05

*Due to skew, hospitalizations were Windsorized

Linear Regressions with Anger and Hostility Sub-Components Predicting All-Cause Hospitalizations*

	$R^2\Delta$	F Δ (df)	B	CI 95%	p
Step One Covariates	Block Non-Significant				
Step Two					
State Anger	.00	.38 (1,138)	.04	-.09 - .17	.54
Trait Anger	.02	2.81 (1,138)	.10	-.02 - .21	.09
Anger Exp Out	.03	4.48 (1,138)*	.15*	.01 - .30	.04*
Anger Exp In	.01	.98 (1, 138)	.07	-.07 - .20	.32
Cynicism	.00	.26 (1,123)	.07	-.19 - .33	.61
Hostile Attribution	.00	.11 (1, 122)	.05	-.24 - .34	.74
Hostile Affect	.00	.16 (1, 124)	.11	-.45 – .67	.69
Aggressive Responding	.00	.07 (1, 124)	-.05	-.45 – .35	.79

*Due to skew, hospitalizations were Windsorized

Linear Regressions with Anger and Hostility Sub-Components Predicting Non-Cardiac Hospitalizations*

	$R^2\Delta$	F Δ (df)	B	CI 95%	p
Step One Covariates	Block Non-Significant				
Step Two					
State Anger	.02	1.57 (1,84)	.08	-.04 - .19	.21
Trait Anger	.05	4.24 (1,84)*	.12*	.04 - .21	.04*
Anger Exp Out	.12	12.48 (1,84)**	.22**	.10– .35	.01**
Anger Exp In	.00	.11(1, 84)	.02	-.11 - .15	.74
Cynicism	.00	.13 (1,79)	.04	-.19 - .27	.72
Hostile Attribution	.01	.40 (1, 80)	-.08	-.35 - .18	.53
Hostile Affect	.00	.08 (1, 81)	.08	-.48 – .64	.78
Aggressive Responding	.02	1.16 (1, 80)	-.20	-.56 – .17	.28

*Due to skew, hospitalizations were Windsorized

Summary

- *Latent construct* of Hostility predicts all-cause hospitalizations and non-cardiac hospitalizations
- *Latent construct* of Anger did not predict hospitalizations
- Of *trait components* of Anger,
  - Anger Expression Out predicts all-cause hospitalizations
  - Anger Expression Out and Trait Anger predict non-cardiac hospitalizations

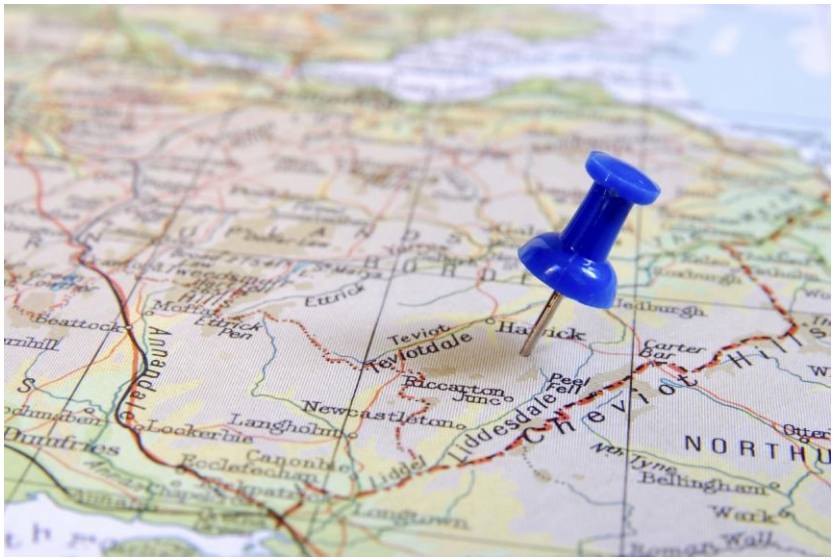
Discussion

- Why all-cause hospitalizations?
  - Hostility and anger subcomponents may be markers of behavioral characteristics that increase risk of hospitalization (e.g. risky behaviors, poor self-care, perceived symptoms, etc.)
  - Mechanisms for these associations may also involve pathophysiological processes (e.g., increased SNS, decreased PNS; immune/inflammatory, etc.)
  - Lack of associations with cardiac hospitalizations suggests that reason for association is not specific to cardiac pathophysiology—consistent with 4 other mortality studies
  - Finding that *Trait Anger* and *Anger Expression Out* predict hospitalizations consistent with reported associations between *Trait Anger* and *Anger Expression Out* with high blood pressure, diabetes, etc.
- Understanding reasons for associations of anger and hostility traits with re-hospitalizations in HF patients may help identify patients at risk of re-hospitalizations and reduce cost of HF treatment

Questions/ Comments

Road Map

- Introduction to the Problem: Heart Failure (HF)
- Anger and Hostility as a Psychological Construct
- Anger, Hostility, and Coronary Heart Disease
- Re-hospitalizations
- Aims and Hypotheses
- Methods
- Results
- Discussion



Introduction to the Problem: Development

- HF is a progressive disease that can begin with atherosclerosis or hypertension
  - Atherosclerosis is: a disease where fat and cholesterol build up within artery walls and restricts blood flow
  - Hypertension is: the force of blood pushing against the walls of blood vessels
- Other immediate markers include:
  - Inflammation
  - Vascular stiffening
  - Endothelial dysfunction
  - Calcification
- Untreated these can lead to:
  - Ischemia
  - Angina
  - Acute myocardial infarction
  - Arrhythmia