Resilience to Stress Across the Lifespan: Childhood Maltreatment, Heart Rate Variability, and Bereavement

Michelle A. Chen, M.A.[1], Robert Suchting, Ph.D [2] , Julian Thayer [3, 4], Ph.D & Christopher Fagundes, Ph.D. [1,5,6]

(1) Rice University, Houston, TX
(2) University of Texas Health Science Center, Houston, TX
(3)University of California, Irvine, Irvine, CA
(4)The Ohio State University, Columbus, OH
(5)The University of Texas MD Anderson Cancer Center, Houston, TX
(6) Baylor College of Medicine, Houston, TX

BACKGROUND & OBJECTIVE

- Following a stressful life event, there is considerable variation in how individuals respond and adapt.
- There are multiple models of risk and resilience showing that adverse childhood experiences can differentially impact an individual's response to stress later in life.
- While there is considerable support that early adversity can sensitize the stress response system and lead to adverse outcomes later in life, there is mounting evidence that in adolescence and young adulthood, certain biological predispositions to stress may promote resilience in the context of subsequent stressors.
- **OBJECTIVE:** Using a mixed-model framework, we evaluated how individual differences in vagally-mediated heart rate variability, an index of an individual's self-regulatory ability, moderated the relationship between childhood maltreatment and grief symptoms across three time points among a sample of individuals experiencing a stressful life event (i.e., spousal bereavement) (n = 130).

METHODS

SAMPLE

- 130 bereaved individuals at 3 time points (i.e., 3 months after the death of a spouse, to 4 months after the death of a spouse, to 6 months after the death of a spouse)

MEASURES

- Heart Rate Variability
  - Polar s810 wristwatch and Wearlink 31 belt band with 1000 Hz sampling rate (Gamelin et al., 2006; Nunan et al., 2009).
  - Preprocessed the raw interbeat intervals for artifacts using KUBIOS HRV analysis software which produced RMSSD
- Self-Report Measures
  - Childhood Trauma Questionnaire (CTQ)
  - Inventory for Complicated Grief (ICG)
  - Center for Epidemiologic Studies Depression Scale (CES-D)
  - Demographics and covariate measures
- Covariates
  - Age, Gender, Education, Days Since Passing, Nicotine Use, Beta-Blockesrs Baseline Depressive Symptoms

ANALYSES

- In each analysis, we utilized GLMM (generalized linear mixed models) to longitudinally model grief symptoms as a function of time. Grief symptoms were measured at approximately 3, 4, and 6 months following the spouse's death.
- Grief symptoms were modeled as a function of the interaction between time (months since baseline) and baseline measures of childhood maltreatment and heart rate variability, controlling for all constituent lower-order interactions and predictors, with random effects to account for correlated observations.

RESULTS

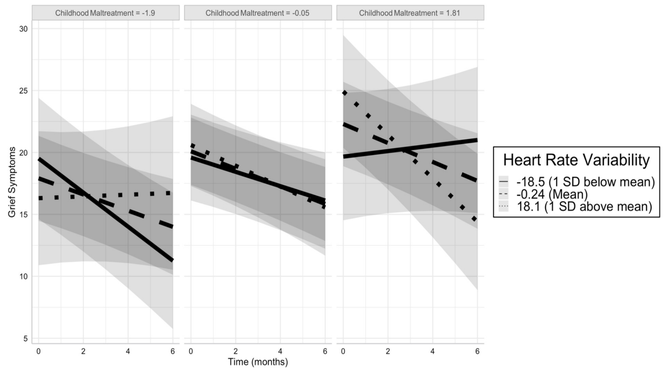
Table 1. *Mixed-Model Analysis of the Interaction of Childhood Maltreatment and Heart Rate Variability Predicting Grief Symptoms Over Time*

	Unadjusted Model			Adjusted Model			Adjusted Model with Depressive Symptoms		
Predictors	*B*	*SE*	*CI*	*B*	*SE*	*CI*	*B*	*SE*	*CI*
(Intercept)	22.40***	1.06	[20.33, 24.48]	50.95***	10.14	[31.07, 70.85]	20.38*	8.43	[3.86, 36.90]
Childhood Maltreatment * Heart Rate Variability * Time (months)	-0.02***	0.01	[-0.04, -0.01]	-0.03***	0.01	[-0.04, -0.01]	-0.03***	0.01	[-0.04, -0.01]
Childhood Maltreatment * Heart Rate Variability	0.05	0.05	[-0.04, 0.14]	0.06	0.05	[-0.03, 0.15]	0.02	0.04	[-0.06, 0.09]
Childhood Maltreatment * Time (months)	-0.04	0.09	[-0.21, 0.13]	-0.04	0.09	[-0.21, 0.13	-0.05	0.09	[-0.22, 0.11]
Heart Rate Variability * Time (months)	-0.01	0.01	[-0.03, 0.01]	-0.01	0.01	[-0.03, < 0.01]	-0.01	0.01	[-0.03, 0.01]
Childhood Maltreatment	1.40*	0.56	[0.30, 2.50]	1.20*	0.57	[0.08, 2.32]	-0.35	0.47	[-1.27, 0.58]
Heart Rate Variability	> -0.01	0.06	[-0.12, 0.11]	0.03	0.06	[-0.08, 0.14]	0.02	0.04	[-0.07, 0.11]
Time (months)	-0.69***	0.15	[-0.99, -0.39]	-0.71***	0.15	[-1.02, -0.41]	-0.69***	0.15	[-0.99, -0.39]
Age				-0.23*	0.12	[-0.46, < 0.01]	-0.05	0.09	[-0.23, 0.13]
Gender				-1.52	2.20	[-5.83, 2.78]	-4.54**	1.71	[-7.89, -1.20]
Education				-0.70	0.92	[-2.50, 1.11]	-0.26	0.71	[-1.65, 1.14]
Days Since Passing				-0.15**	0.06	[-0.26, -0.04]	-0.07	0.05	[-0.16, 0.02]
Nicotine Use				0.38	5.36	[-10.12, 10.89]	1.21	4.11	[-6.82, 9.27]
Beta-Blockers				3.81	2.41	[-0.91, 8.53]	0.56	1.88	[-3.12, 4.25]
Depressive Symptoms							0.73***	0.08	[0.57, 0.88]
Random Effects									
σ^2	19.32			29.19			19.01		
τ_{00}	119.98 $_{Subject}$			119.94 $_{Subject}$			66.05 $_{Subject}$		
ICC	0.86			0.86			0.78		

Note: * indicates $p < .05$; ** indicates $p < .01$; *** indicates $p < .001$

- Our primary analysis indicated a significant 3-way interaction between childhood maltreatment, heart rate variability, and time predicting grief symptoms in unadjusted and adjusted models (unadjusted: $b = -0.02$, $p < .001$; adjusted: $b = -0.03$, $p < .001$; Figure 1).

Figure 1. *Interaction of Childhood Maltreatment and Heart Rate Variability (rmssd) Predicting Grief Symptoms Over Time*



- Among participants with low childhood maltreatment (i.e., left panel of Figure 1), those with low baseline heart rate variability exhibited a decrease in grief symptoms over time (unadjusted: $b = -1.35$, $p < .001$; adjusted: $b = -1.38$, $p < .001$), while those with high baseline heart rate variability did not experience changes in grief symptoms over time.
- Among participants with average levels of childhood maltreatment (i.e., middle panel of Figure 1), grief symptoms decreased over time, irrespective of heart rate variability levels (among individuals with low heart rate variability: unadjusted: $b = -0.56$; $p = .011$; adjusted: $b = -0.58$, $p = .009$; among individuals with high heart rate variability: unadjusted $b = -0.82$; $p < .001$: adjusted: $b = -0.84$; $p < .001$).
- Finally, among participants with high childhood maltreatment (i.e., the right panel of Figure 1), those with high baseline heart rate variability exhibited a decrease in grief symptoms over time (unadjusted: $b = -1.72$, $p < .001$; adjusted: $b = -1.76$, $p < .001$) while those with low baseline heart rate variability did not experience changes in grief symptoms over time.

CONCLUSION

- The present study aims to help resolve the apparent discrepancy between divergent models of adverse childhood experiences and adjustment to stressful life events among older adults.
- Findings from this study provide further evidence for factors (i.e., heart rate variability) contributing to divergent patterns of adaptability to a stressful life event later in life.
- Future studies can continue to explore mechanisms underlying this relationship and interventions to promote high heart rate variability, a potential resilience factor, to buffer the relationship between childhood maltreatment and grief symptoms following the loss of a spouse.

This work was supported by the National Heart, Lung, and Blood Institute (1R01HL127260-01) and National Institute of Aging (1F31AG069439-01). This poster was presented as part of the SSHD 2021-22 Conference Series on June 14, 2022.
Contact: *Michelle.A.Chen@rice.edu*