Avoidance, Hyperarousal, and Re-experiencing after MVC Share a Common Vulnerability Substrate

Chang BP[1], Lane S[2], Bollen KA[2,3], **Flotron SB[4,5]**, Borde AR[4,5], Swor RA[6], Peak DA[7], Rathlev N[8], Lee DC[9], Domeier R[10], McLean SA[4,5,11]

[1]Department of Emergency Medicine, Columbia University Medical Center, New York City, NY; [2] Department of Psychology and Neuroscience, University of North Carolina, Chapel Hill, NC; [3] Department of Sociology, University of North Carolina, Chapel Hill, NC; [4]Institute for Trauma Recovery; [5] Department of Anesthesiology, University of North Carolina, Chapel Hill, NC; [6] Department of Emergency Medicine, William Beaumont Hospital, Royal Oak, MI; [7] Department of Emergency Medicine, Massachusetts General Hospital, Boston, MA; [8] Department of Emergency Medicine, Baystate Medical Center, Springfield, MA; [9] Department of Emergency Medicine, North Shore University Hospital, Manhasset, NY; [10] Department of Emergency Medicine, Saint Joseph Mercy Health System, Ann Arbor, MI; [11] Department of Emergency Medicine, University of North Carolina, Chapel Hill, NC

Introduction

- Avoidance, hyperarousal, and re-experiencing are symptom clusters of central importance to posttraumatic stress (PTS).[1]
- The relative severity of these symptom clusters is known to vary within and between individuals with PTS. However, whether individual vulnerability to these three symptom clusters is generally shared vs. distinct remains poorly understood.[2,3,4,5]
- In this analysis we used structural equation modeling (SEM) to test whether a model hypothesizing a common vulnerability substrate to the development of all three symptom clusters vs. a model proposing distinct symptom cluster vulnerability provided a better fit to the data.
- Data for analyses were drawn from a large prospective cohort study of European presenting to the emergency department (ED) after motor vehicle collision (MVC), with high follow-up rates across time.

Methods

- Participants presenting to one of nine emergency departments within 24 hours of MVC were enrolled.
- Symptoms of PTS were assessed using the Impact of Events Scale – Revised (IES-R) at 6 weeks and 6 and 12 months.[6]
- Measurement models of latent variables were developed, and SEMs were evaluated that did (Figure 2) and did not (Figure 3) include a higher order shared vulnerability factor for the three symptom clusters. Goodness of fit of competing models were compared.

Table 1. **Model fit indices of the measurement models**

Measurement Models	N	p(χ^2)	df	RMSEA	CFI	TLI	BIC
Three-Factor Model, All Items	859	<.001	206	.083	.954	.948	36.53
Intrusion Model, All Items	859	<.001	20	.075	.990	.986	-19.03
Avoidance Model, All Items	859	<.001	20	.053	.992	.989	-66.72
Hyperarousal Model, All Items	859	<.001	9	.088	.989	.981	7.73
Intrusion Model, Reduced Item Set	859	.038	2	.052	.999	.996	-6.95
Avoidance Model, Reduced Item Set	859	.013	5	.047	.998	.996	-19.32
Hyperarousal Model, Reduced Item Set	859	.532	2	.000	1.00	1.001	-12.25
Higher-Order Factor Model, Reduced Items	859	<.001	62	.064	.986	.982	-140.43
One-Factor Model, Reduced Item Set	859	<.001	65	.09	.971	.965	78.645
Higher-Order Model, Add Predictors of vulnerability	854	<.001	110	.051	.984	.982	-385.68
Three-Factor Model, Add Predictors of lower-Order Factors	854	<.001	102	.053	.985	.980	-343.49

Table 2. **Reduced Impact Events Scale Revised**

Subscale	Item
Intrusion	Iesr 3,6, 9,14
Avoidance	Iesr 8, 11, 12, 17, 22
Hyperarousal	Iesr 4, 18, 19, 21

Figure 1. **Recruitment network**

Table 3. **Study cohort characteristics for individuals in final model (N=854)**

Characteristics	Frequency
Age (mean, SD)	36.1, 13.4
Female (%)	63%
FKBP5 Risk Allele (%)	57%
Driver (%)	86%
Education (%)	
8-11 years	4.2%
>12 years or high school	18.1%
Post high school	6.1%
Some college	32.5%
College graduate	26.1%
Post graduate	12.9%

* All numbers are percentages except for age and number of body parts struck
* N = 854 reflects the number of cases used in the final, full model

Figure 2. **Higher-order factor model**

This higher order model, hypothesizing shared underlying vulnerability to intrusion, avoidance, and re-experiencing, provided a superior fit to the data as compared to the three factor model (Figure 3) positing distinct vulnerabilities to each outcome (e.g., BIC -385.68 vs -343.49).

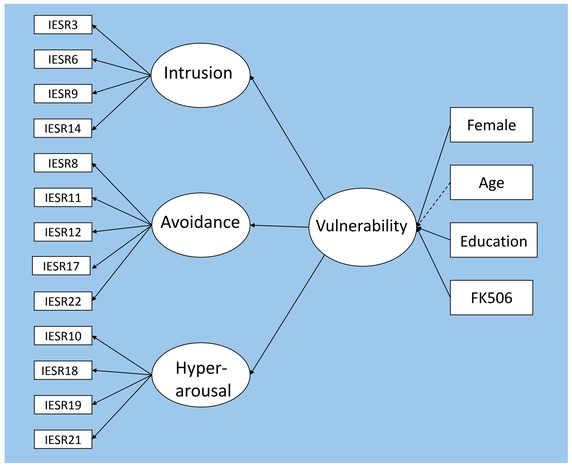
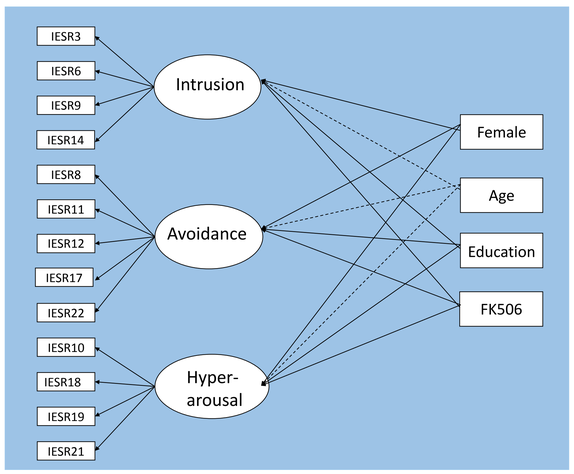


Figure 3. **Three factor model**



Results

- European Americans (N = 948, 63% female, mean age 36) presenting to the emergency department after MVC were enrolled; follow-up rates at 6 weeks and 6 and 12 months were 91%, 89%, and 91%, respectively.
- Measurement models of PTS symptom clusters provided an excellent fit to the data (Table 1).
- The model hypothesizing a common vulnerability underlying the development of re-experiencing, hyperarousal, and avoidance symptoms provided much better fit to the data than competing models (see figure 2 and 3)
- In a full SEM, female sex ($\beta = .276$, $p < .001$) and possessing one or more copies of the *FK506* risk allele ($\beta = .175$, $p<.003$) also influenced the higher-order latent vulnerability factor (Figure 2).

Conclusions

- These data suggest the presence of shared vulnerability to the development of re-experiencing, avoidance, and hyperarousal symptoms after MVC.
- Further studies are needed to better understand the biobehavioral pathogenesis of individual symptom clusters central to the suffering of individuals with posttraumatic stress.

References

[1] American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

[2] Taylor S, Kuch K, Koch WJ, Crockett DJ, Passey G. The structure of posttraumatic stress symptoms. J Abnormal Psychology 1998;107:154-160.

[3] King D, Leskin G, King L, Weathers F. Confirmatory factor analysis of the clinician-administered PTSD scale: evidence for the dimensionality of posttraumatic stress disorder. Psychological Assessment 1998;10:90-96.

[4] Elhai JD, Palmiere PA. The factor structure of posttraumatic stress disorder: a literature update, critique of methodology, and agenda for future research. J Anxiety Disorder 2011;6:849-854.

[5] Simms LJ, Watson D, Doebbeling BN, Confirmatory factor analyses of posttraumatic stress symptoms in deployed and nondeployed veterans of the Gulf War. J Abnormal Psychology 2002;111:63-647.

[6] Weiss DS, Marmar CR. The impact of event scale – revised. In: Wilson JP, Keane TM, editors. Assessing psychological trauma and PTSD. New York: Guilford Press; 1997. 399–411.

Funding

Research reported in this presentation was supported by the National Institute of Health under Award Number R01 AR01AR056328. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.