National Clinician Scholars Program

ORTNER CENTER ON VIOLENCE & ABUSE
UNIVERSITY OF PENNSYLVANIA

THE ALICE PAUL CENTER FOR RESEARCH ON GENDER, SEXUALITY & WOMEN

Ineffective Affective Processing

Neural correlates of cognitive control in women with a history of sexual violence

Laura Sinko PhD, RN, CCTS-I, National Clinician Scholar, Perelman School of Medicine
Paul Regier PhD, Postdoctoral Fellow, Center for Studies on Addiction, Perelman School of Medicine
Anne Teitelman PhD, FNP-BC, FAANP, FAAN, Associate Professor, Penn School of Nursing
Subash Aryal PhD MS, Research Associate Professor, Penn School of Nursing
Adrian Curtin PhD, Research Engineer, Optical Brain Imaging Lab, Drexel University
Hasan Ayaz PhD, Associate Professor, School of Biomedical Engineering, Science and Health Systems, Drexel University
Anna Rose Childress PhD, Research Professor of Psychology in Psychiatry, Perelman School of Medicine

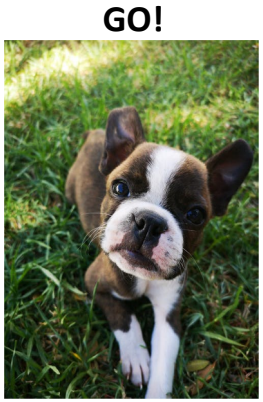
Introduction

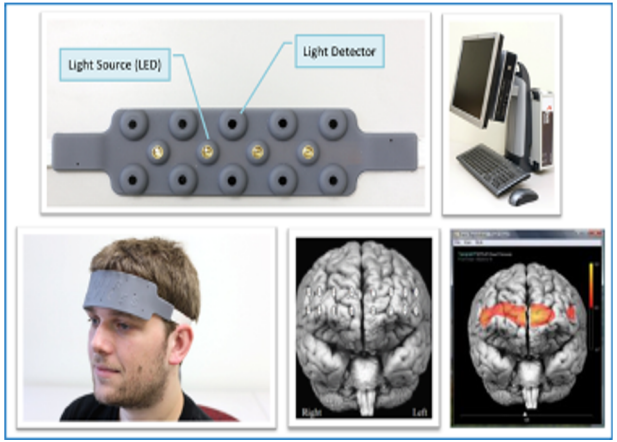
- Women's experiences of sexual violence (SV) can be not only psychologically and physically traumatizing, but also may have lasting effects on brain functions, including cognitive control relating to the inhibition and processing of emotion.[1]
- While many studies have investigated associations of trauma and cognitive control, few have explored underlying neural correlates of SV's impact on cognitive control in women.[2-3]

- **The purpose of this study was to understand cognitive control differences between women who have a history of SV vs. those who do not (no SV) using functional near-infrared spectroscopy (fNIRS), a portable neuroimaging technology used to measure activity in brain regions associated with inhibitory control.**
- We hypothesized that prior SV might be linked to poor inhibition, and to lower recruitment of cognitive control circuitry.

Methods

- Thirty women (ages 21-30) were recruited from an urban setting in the northeastern US.
- Surveys assessed demographic and mental health characteristics including SV history (i.e. childhood and adult SV).
- All participants underwent an affect-congruent Go-NoGo task, using positively-valenced (baby animal) pictures as “Go” stimuli , and negatively-valenced (spiders, scorpions) pictures as NoGo stimuli, while prefrontal activity was monitored by 16 optodes via fNIRS.[4]
- An ANOVA tested for main effects of group (SV vs. no prior SV), condition (Go vs. No-Go), and potential interactions.



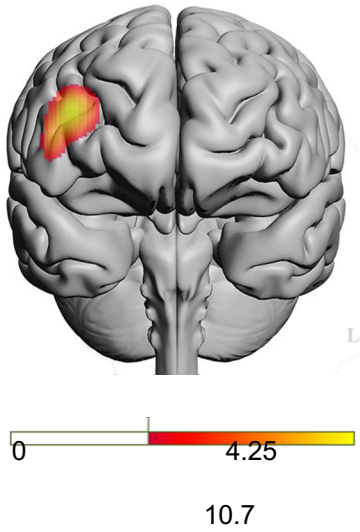


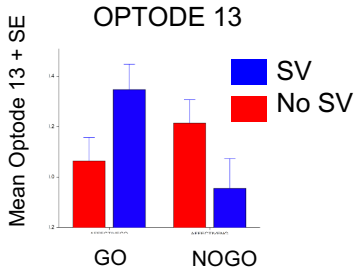
Results

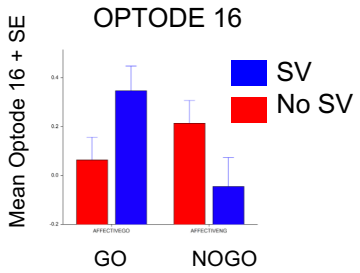
15 of **30** women reported a history of childhood (n=6) and/or adult (n=12) sexual violence (SV).

	Total Sample Mean *(SD)*	**SV Group** Mean *(SD)*	**No SV Group** Mean *(SD)*	**Significance** (p< 0.05)
Age	25 *(2.37)*	24.73 *(2.34)*	25.27 *(2.46)*	p=0.54
Depression (CESD)	14.07 *(10.29)*	20.60 *(10.71)*	7.53 *(5.52)*	**p<0.01**
Anxiety (GAD-7)	30 *(7.04)*	33.53 *(6.93)*	26.47 *(5.28)*	**p<0.01**
Post Traumatic Stress (PCL-5)	27.7 (8.50)	32 *(8.38)*	23.47 *(6.34)*	**p<0.01**
Impulsivity (BIS)	61.4 (10.20)	65.13 *(10.11)*	57.67 *(9.12)*	**p=0.02**

*Behavioral performance on the imaging task did not significantly differ between the groups.







Left: There was a significant interaction in the lateral dlPFC (optodes 13 and 16). **Right**: Women with SV had lower recruitment in the dlPFC during the "NoGo" condition, but heightened recruitment during the "Go" condition; the no SV group exhibited the opposite pattern (higher during "NoGo" and lower during "Go").

Discussion/ Conclusion

- These results suggest altered prefrontal cortical activity during cognitive processing in women with a history of SV, showing hypoactivity in regions important to response inhibition and hyperactivity to the positive/ approach stimuli.
- These findings highlight a significant link between SV and critical brain functions, demonstrating a strong translational promise for innovative assessment and prevention of untoward effects (impaired affective processing) among women with SV.
- FNIRS offers great potential for future inquiry in SV populations, providing critical knowledge that can be used to guide brain and behavioral interventions for SV recovery.

Acknowledgements

Financial Support: NIMH R21 MH097583 (Teitelman and Childress, MPI); Penn SON Faculty Pilot Grant Program (Teitelman); University of Pennsylvania, Provost's Research Facilities Development Fund (Teitelman/Childress); T32DA028874-10 (Childress); Drexel BIOMED Faculty Dev Award (Ayaz)

References

1. Ullman, S. E., Peter-Hagene, L. C., & Relyea, M. (2014). Coping, emotion regulation, and self-blame as mediators of sexual abuse and psychological symptoms in adult sexual assault. *Journal of Child Sexual Abuse*, *23*(1), 74-93.
2. Rodrigo A, Di Domenico, S. I., Ayaz, H., Gulrajani, S., Lam, J., & Ruocco, A. C.,. Differentiating functions of the lateral and medial prefrontal cortex in motor response inhibition. *Neuroimage.* 2014.
3. Nicholson, A. A., Rabellino, D., Densmore, M., Frewen, P. A., Paret, C., Kluetsch, R., ... & Reiss, J. (2017). The neurobiology of emotion regulation in posttraumatic stress disorder: Amygdala down regulation via real-time fMRI neurofeedback. *Human Brain Mapping*, *38*(1), 541-560.
4. Goldman, M., Ehrman, R. N., Suh, J. J., Hurt, H., Marquez, K., Franklin, T. R., ... & Childress, A. R. (2015). Brief report:"Spiders-No, Puppies-Go", introducing a novel Go NoGo task tested in inner city adolescents at risk for poor impulse control. *Journal of Adolescence*, 45.