National Conference of State Legislatures
Task Force on Military and Veterans Affairs

Using Physiology, Not Guess Work, to Measure the Mental Health of Our Military Dependents

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Using Physiology, Not Guess Work, to Measure the Mental Health of Our Military Dependents

The Issue:

1. Children in military families tend to have higher rates of mental health problems than those in the general population.

2. These mental health problems are especially pronounced during a parent’s deployment.
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The Issue:

Peer Reviewed Evidence:

- Thirty-two percent of children of military families scored as “high risk” for child psychosocial morbidity, *2.5 times the national average.* (Flake et al., 2009)
- There is a higher prevalence of emotional and behavioral difficulties in youth aged 11 to 17 in military families compared to the general population. (Chandra et al., 2010)
- During a parent’s deployment, children exhibit behavior changes including changes in school performance, lashing out in anger, disrespecting authority figures, and symptoms of depression. (Huebner et al., 2005)
- Children age 3 to 5 with a deployed parent exhibit more behavioral symptoms than their peers without a deployed parent. (Chartrand et al., 2008)
- The rate of child maltreatment in families of enlisted Army soldiers is 42 percent higher during combat deployment than during non-deployment. (Gibbs et al., 2007)
- SecDef recognizes need for focus on military dependents mental health. (SecDef 1 Oct 2014)
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Our Approach:

Test the assessment tools we have already developed for Military Personnel to see if they are of use in children who are military dependents.
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Our Goal:

1. To test the newest physiologically based assessment tools to identify children in need of psychological help.
2. Use these tools to track military dependents over time.
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What is the newest tool?

The Integrated Neuropsychiatric Assessment System (INAS)

A Generic Platform for Assessment of CNS Health
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The INAS:

1. DoD funded.

2. Initially developed for evaluation of traumatic brain injury, but generically applicable to neuropsychiatry and mental health.
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What Makes INAS Special?

Simultaneous Data Acquisition:
- neuropsychological assessment (Cognitive, Reaction time)
- autonomic nervous system (EKG)
- central nervous system (EEG)
- event related potentials (EEG response to targets)

Onboard analysis of acquired signals

Integrate results with additional data sources
Integrated Neuropsychiatric Assessment System (INAS)

- **Patient History**
  - Medical/Psych Hx
  - Familial Indices
  - Environmental Indices
  - Physical Fitness
  - Socioeconomic Status

- **Imaging**
  - fMRI
  - DTI
  - PET
  - Genomics
  - Plasma
  - Blood
  - CSF

- **Neurological & Psychiatric Assessment Instruments**
  - Individual Tests
  - Instrument Specific Output

- **Neuropsychological Evaluation**
  - NCAT
  - Simon Task
  - Flanker
  - ANS Eval

- **Electrophysiology**
  - EEG
  - EMG
  - Eye Tracking
  - HRV Balance
  - EP ERP
  - Sleep qEEG

- **SIMULTANEOUS ACQUISITION**

- **Delta Analysis**
  - Conditional Accuracy Functions
  - Transition Detection
  - Synchronization

- **Causality**
  - Small World Models

- **Integrated Analysis**
  - Model Selection
  - Random Forest Classifier

- **Results Documentation**
It’s the novel mathematics that makes this tool so unique and powerful!
Integrated Neuropsychiatric Assessment System (INAS)

Digital Tachistoscope

Common Electrode Cap (20 to 72 Channels)

Laptop Rugged/Milspec

20 Channel Amplifier (expandable to 72 chan)

Free Standing Battery Powered
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Electrophysiology Example:

1. Event Related Potentials
   • Odd-Ball task – presentation of vertical and horizontal lines (one to be TARGET, and one to be non-target)
   • Relates to amount of brain energy devoted to cognitive processing
Event Related Potentials

Difference in Response to Vertical Target

Healthy Control

mTBI

Voltage (uV)

Time (seconds), t=0 at stimulus onset

Difference in Response to Vertical Target

Healthy Control

mTBI

Voltage (uV)

Time (seconds), t=0 at stimulus onset

Healthy Control

mTBI
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Electrophysiology Example:

2. Heart Rate Variability (HRV)
   • Measure of Autonomic Nervous System function
   • ‘Fight or Flight’ v. ‘Rest and Digest’
Hypothesized Results

- Baseline (eyes closed)
- Cognitive Challenge
- Natural Recovery (eyes closed)
- Paced Breathing

Controls
- Vulnerable

Fully Expressed Complex Trauma

HRV vs. Time (Minutes)
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Apply INAS to Adolescent Population:

Hypothesis: Adolescents with Complex Trauma (CT) represent a population far removed from Healthy Controls (CON)
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Complex Trauma:
Combination of early and late onset, sometimes highly invasive traumatic events, usually of an ongoing, interpersonal nature, frequently including exposure to repetitive childhood sexual, physical, and/or psychological abuse. (Briere and Scott, 2006; Cook et al., 2005).
Hypothesis:

Adolescent Military Dependents presenting for counseling (AMD-ct) represent an identifiable population between CON and CT groups.
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Plan:

Experimental Design:

a. Four Groups

1. Healthy Controls (CON)
2. Adolescent Military Dependents – Healthy (AMD-con)
3. Adolescent Military Dependents – seeking counseling (AMD-ct)
4. Complex Trauma (CT)
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Plan:

Experimental Design:

b. Three Phases

1. Phase 1
   • Physiological characterization of groups

2. Phase 2
   • Longitudinal characterization of groups
   • Four time pts (Assessment, 3, 6 and 12 mos)

3. Phase 3
   • Assessment of treatment (standard of care)
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Plan:

   Experimental Design:

   c. Standard Instruments:

       1. Childhood Trauma Questionnaire
       2. Symptom Checklist – 90
       3. Mini-KID
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Plan:

Experimental Design:

d. Novel Instruments:

1. Key Developmental Assets (Tectree, Inc.)
   a) Tool for longitudinal assessment of treatment progress.

   b) At-home instrument to track progress, problems, and successes.

   c) Source for help in treatment adherence.
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Plan:
Adolescent Availability (USU +):

1. Healthy Controls (CON)
   - Chatham County Board of Education, NC
   - Middle and High School Students

2. Adolescent Military Dependents (AMD-con, AMD-ct)
   - Womack Medical Hospital, Ft Bragg, NC
   - University of Central Florida, FL
   - Fayetteville Family Life Center, NC

3. Complex Trauma (CT)
   - Womack Medical Hospital, Ft Bragg, NC
   - Fayetteville Family Life Center, NC
   - Full Circle Family Counseling, NC
   - Grandfather Home, NC
   - Piscah Institute, NC
   - The Trauma Center at JRI, MA
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Scientific Advisory Board:

**Bessel A. van der Kolk, M.D.**  
Professor of Psychiatry, Boston University School of Medicine  
Medical Director, The Trauma Center, Brookline, MA  
The National Child Traumatic Stress Network

**Theodore R. Bashore, Jr., Ph.D.**  
Professor of Psychology  
College of Education and Behavioral Sciences  
University of Northern Colorado, CO

**Stephen W. Porges, Ph.D.**  
Professor of Psychiatry and Bioengineering  
Director, Brain-Body Center, IL

**Alfonso M. Albano, Ph.D.**  
Marion Reilly Professor Emeritus  
Department of Physics  
Bryn Mawr College, PA
Hypothesized Results

- Baseline (eyes closed)
- Cognitive Challenge
- Natural Recovery (eyes closed)
- Paced Breathing

Controls
CON
AMD-con
Vulnerable
AMD-ct
Fully Expressed
Complex Trauma
CT
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Potential Impact of Findings:


2. Offers physiology-based metrics for tracking therapeutic progress in adolescents.
   - INAS provides information for clinicians about efficiency of intervention/treatment plan.

3. Ability to identify vulnerable populations (i.e. low resilience) for EARLY intervention.
   - EARLY intervention = healthier next generation military recruitment pool.
   - EARLY intervention = lower medical costs.
   - EARLY intervention = healthier adult populations.
   - EARLY intervention = lower suicide/homicide incidence.
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Thank you!

Questions?
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**Timeline**

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**Proposed Budget**

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</table>
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Our team:

**TIRP**
- David O. Keyser, Ph.D.
  - Neurophysiologist
- Chris Cellucci, Ph.D.
  - Physicist
- Chao Wang, Ph.D.
  - Biomedical Engineer

**KDA**
- Joy Kelleher
  - Core Assets
- Sharon Bird
  - Liaison/Consultant

**Core Assets**
- Paul E. Rapp, Ph.D.
  - Physicist/Mathematician
- David Darmon, Ph.D.
  - Statistician
- Kylee Bashirelhai
  - Research Coordinator