INNOVATIONS IN COMMUNITY INTEGRATED BRAIN INJURY REHABILITATION FOR SERVICE MEMBERS: THE DVBIC CHARLOTTESVILLE EXPERIENCE AND OVERVIEW OF DVBIC CIVILIAN PROGRAMS THROUGH 6/13
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DISCLAIMER AND ACKNOWLEDGEMENT

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Dr. Don Nidiffer
DVBIC-JOHNSTOWN’S CONTINUUM OF CARE

1. Outpatient Clinic

2. Community Re-entry
   - Transitional (24hr supervision)
   - Independent Living

3. Extended Stay Therapy Program
   - Intensive Residential Therapy Focus

4. Vocational Rehabilitation
   - Available to all levels of Care
CLINICAL/REHABILITATION STAFF

- **Medical Services**
  - Physicians
  - Board Cert. Physiatrist
  - Board Cert. Psychiatrist
  - Behavioral/Clinical Manager
  - Nursing
  - Case Management

- **Rehabilitation Services**
  - Neuropsych/Psychologist
  - Behavioral Health Team
  - Physical Therapist
  - Occupational Therapist
  - Speech-Language Pathologist
  - Recreation Therapist
  - Vocational Counseling

- **Residential Services**
  - Residential Manager
  - Community Integration Specialist
  - Family Program Support
  - Pastoral Services
  - Client Advocates
INNOVATIVE REHABILITATION AND ENRICHED THERAPEUTIC ENVIRONMENT

- Horticulture, Pet therapy, Yoga
- Art and music therapy
- Community outings and activities
- TBI support group
- Case management collaboration with VA, DoD and civilian systems of care
- Family liaison, hospitality suite and recreational room.
- Therapeutic horseback riding
- Multi-Sensory Room
- Video communication with family
- Cognitive rehabilitation
- Health and Wellness Programs
- Adventure therapy (high and low ropes, plus climbing wall)
**Vocational Opportunity**

- Pre-vocational Training
- Career Exploration and Assessment
  * Transition to Work
  * Transferable Skills Scale
  * Work Preference Match
  * Career Exploration Inventory
  * Job Search Attitude Inventory
- Supervised Volunteer Work Experience and Job Coaching
- Career Assessment
- Military to Civilian Employment Transition
- Work Life Balance Coaching

**Family Support Services**

- **Travel Assistance**
  * Travel Arrangements and Reservations
    - Angel Flight and Fisher House
- **Out-of-town Services**
  * DVBIC Johnstown provides guest accommodations / on-site Family Suite
- **Communication**
  * Facebook, MySpace, Skype, etc
  * Holiday cards, phone calls and emails
- **Networking**
  * Family Support Program Resources
    - Red Cross Volunteer Services
    - Legal Assistance
    - Advocacy
DVBIC - CHARLOTTESVILLE REHABILITATION PROGRAMS
**DVBIC - CHARLOTTESVILLE REHABILITATION PROGRAMS**

**BEYOND TRADITIONAL TBI REHABILITATION MODEL FOR VA POLYTRAUMA SYSTEM**

- Finishing School for “real life” rehabilitation/community reintegration with full rehabilitation team
- Embedded community re-entry program with 24 hour supervised home and transitional apartment programs
- Over 25 different community job opportunities
- Return to duty trial vocational experiences at UVA’s Judge Advocate General School (JAG) and the National Ground Intelligence Center (NGIC)
- UVA and military postdoctoral fellowship rotations and internship placements
- Clinical and research collaborations with UVA, VCU, Hunter McGuire VAMC, and WWRC/DRS
DVBIC - CHARLOTTESVILLE REHABILITATION PROGRAMS
RESEARCH INITIATIVES

Multi-center Research Study Participation:

Research Disseminated/In Dissemination Process:
2. Applications of Global Positioning System Technology (GPS) in Community Integrated Brain Injury Rehabilitation - presented
3. Qigong as a Novel Intervention for Service Members with Mild Traumatic Brain Injury - presented
4. Non-Invasive Assay to Discriminate Between Mild TBI and PTSD

Research Studies Partially Completed:
1. Application of Instructional Technology Software as a Cognitive and Vocational Rehabilitation Tool Post-TBI
2. Traumatic Brain Injury Residential Rehabilitation and Community Re-Entry Model Program for Service Members
Maintained Charlottesville, VA locations – home, apartments, clinic, vocational, social space
Community Integrated Rehabilitation (CIR)
Developed CIR Manualized Treatment Modules
Technology Research
Outpatient and Vocational Rehabilitation
Family-style Residences
Community Clubhouse
Outpatient /Day Program Clinic
Affiliated with UVA Medical/Neuropsychology
DVBIC CHARLOTTESVILLE REHABILITATION PROGRAMS – FIRST OF ITS TYPE TO BE CARF ACCREDITED (2007)

Three year accreditation (2007, 2010)
All four relevant categories:
  » Brain Injury Outpatient Rehab (DVBIC)
  » Brain Injury Residential rehab (DVBIC)
  » Brain Injury Long-Term Residential
  » Community Services: Community Integration
DVBIC CHARLOTTESVILLE—PROFILE 2007-2010 SYNOPSIS

Served 30-35 service members annually

PTSD-70% (OEF/OIF); ETOH – 30%

90% OEF/OIF; 10% Other

40% National Guard –

» 100% discharged to home/community

Active Duty Participant Outcome

» 50% returned to active duty

» Some reclassified to another MOS

» 50% retained for MEB and eventual DC back to assigned military base

» 5 DC Due to ETOH issues
### DETAIL DESCRIPTORS OF 40 CONSECUTIVE 2008-2009 DISCHARGES

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
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<tbody>
<tr>
<td>Age</td>
<td>31.86</td>
<td>9.88</td>
</tr>
<tr>
<td>Time Since Injury</td>
<td>46.68</td>
<td>39.00</td>
</tr>
<tr>
<td>Length of Stay</td>
<td>13.09</td>
<td>7.65</td>
</tr>
</tbody>
</table>

All male (not typical)
Customer Satisfaction Rating 2008-2009

**Key:**
1. Residence
2. Treatment Plan
3. Treatment Effectiveness
4. Inclusion
5. Communication
6. Courtesy/Respect
7. Food
8. Housekeeping
9. Leisure and Recreation
10. Vocational
11. Family Services
12. Overall Rating
DVBIC CHARLOTTESVILLE

Bookstore/Gallery & Clubhouse downtown
BOOKSTORE/GALLERY & CLUBHOUSE DOWNTOWN
ART GALLERY RE-OPENING
RESIDENTIAL LIVING
THERAPY PROGRAM

- **Individualized Therapy**
  Outpatient Neuro/Psychology
  PT, OT, SLP, Vocational
  1-5x weekly

Community Integrated Rehab Curriculum

Module based interactive/educational program to develop skills, learn about BI and practice effective strategies in a “real world” setting

Interactive groups featuring psychological coping, home life, community issues, work skills, social skills, art, leisure, wellness, conflict resolution, adjustment issues, substance abuse prevention, compensatory techniques, assistive technology, voc trials
THERAPY PROGRAM

Brain Injury Education
Foundation for Modules and treatment Manual Development
Cognitive & Psychosocial Skills
Problem Solving
Wellness
Support System
Life Roles
Teamwork
‘Community’
PHYSICAL THERAPY
SPEECH THERAPY
VOCATIONAL PROGRAM

- Used Bookstore/Gallery (Enclave)
- Mentorship (Advocacy)
- Supported Employment
- Situational & Job site assessments
- Cognitive strategies & Job coaching
- Partnerships (JAG School, Habitat, recruiting offices, NGIC, hospital, gym)
Clinical Initiatives that Contributed to Success:

» 24 hour remote web-based cognitive tools access and interactive instructional technology
» Expanded individual, group and community-based drug & alcohol counseling;
» Consulting on-site psychiatry, access to specialists
» Expanded PTSD and family/marital therapy
» Horticultural Therapy Program (with UVA and community support) including on-site greenhouse
» Increased connections with local faith community and veteran’s groups
» Music therapy & Art therapy
» Animal facilitated therapy with therapy dog
» Assistive Technology implementation
» On-site gym to compliment community gym
MODULES

Module Template

Intro: Literature Review of Problem and Treatment (Theories, Evidence Based Info, Best Practices)
Assessment of the Symptoms/Sequelae
Approaches to Managing the Symptoms
MODULES

Module Template

Systematic Approach to Intervention: Methods of Intervention with Examples

Materials to use in the Intervention

Outcome Measures and Evaluation

Consistent template to be sure that it is simple, efficient, useable, entertaining.

Convert to IT enabled platform
TBI REHABILITATION, RETURN TO DUTY, AND COMMUNITY RE-ENTRY: MILITARY MODULAR INTERVENTION PROGRAM

1. Intro: Group Process & Engaging the Participant
2. Wellness: Fatigue, Relaxation, Stress, Nutrition, Sleep
3. Physical Therapy, Exercise, Flexibility, Coordination, Pain
4. Executive Function, Problem Solving, Awareness
5. Focusing Attention, Improving Memory, Compensation
6. Maximizing Memory in Functional Environments
7. Time Management & Organizing Everyday Life
TBI REHABILITATION, RETURN TO DUTY, AND COMMUNITY RE-ENTRY: MILITARY MODULAR INTERVENTION PROGRAM

8. Behavioral Challenges, Anger Management
9. PTSD, Depression, Anxiety
10. Communication
11. Substance Abuse & TBI
12. Social Interaction & Community
13. Family/Life: Intimacy, Parenting, & Spirituality
14. Maximizing the Rehabilitation Experience
Non-Invasive Assay to Discriminate Between Mild TBI and PTSD

PI: Jeffrey T. Barth, PhD
Location: DVBIC Charlottesville Rehabilitation Programs
Collaborating Institutions: Fort Lee, Hunter Holmes McGuire Veteran’s Administration Medical Center, Univ. of Virginia.

### Aims
- To investigate a method of quantitative assessment of mTBI severity.
- To develop quantitative assessment to ultimately provide support for a decision regarding clearance for return to duty (RTD), E2 stay for temporary management or evacuation to a higher care level.
- To provide quantitative assessment of recuperation. In a passing traumatic injury case, this would provide assessment metrics over the course of days at E2 until the subject is cleared. In more severe cases, the assessment metrics would track the physiological cerebral recovery which would drive the selection of the most effective treatment and drug therapies.

### Approach
- The present study will utilize a sensorized platform that assesses center-of-mass sway, which has been shown to be a very sensitive tool to assess postural stability.
- The present study will also utilize an optical detection system used to measure eye movement based on discrete element infrared limbus tracking.

### Status
**Deliverables/milestones in the last quarter**
- This multi-center study has completed IRB approval process.: The project has been approved by the local IRB for DVBIC Charlottesville; NEIRB approval 17 DEC 10, edited and revised approval 10 JUN 11, and now all in renewal and maintenance
- USAMRMC and DVBIC approval completed.
- Continuing renewals of IRB packets across sites.
- Participant enrollment was completed first quarter 2013.
- Protocol closed for pilot data analysis with 46 participants from the multi-center program, 10 participants of whom were also participants at DVBIC-Charlottesville

**Key Challenges**
- Complexities of multi-site approvals and IRB process and renewals are on-going
- Recruitment target of 300 participants across 3 study sites – Ft. Lee, VAMC-Richmond and DVBIC-Charlottesville has been reduced to a pilot study with 46 participants

**Deliverables/milestones anticipated in the next year**
- IRB processes will be completed and renewals submitted on time
- The analyses of pilot data will occur in the first half of 2013
- The dissemination of study findings will occur in the second half of 2013.
PARTNERSHIP AMONG DVBIC AND DOD SITES WITH UVA AND EMPIRICAL TECHNOLOGIES CORPORATION

EMPIRICAL TECHNOLOGIES CORPORATION

ETC's mission is the development of sensor technologies for physiological monitoring applications in both humans and animals.
PROJECT PRIORITY

Develop and validate military-relevant standards for making return-to-duty (RTD) decisions that are related to mTBI issues. Specifically, the need to promptly assess and diagnose service members suspected of having suffered a mTBI using cost-effective and objective tools in the context of in-the-field screening is still awaiting an adequate solution. At the same time the scientific evidence is now unequivocal regarding the deleterious consequences of re-injury of a concussed brain as a result of false negative classification and/or the intentional masking by the service members.
CBIAS ASSESSMENT DESCRIPTION

The assessment is based on a battery of 8 eye movement tests, including smooth pursuit (SPEM), and 6 stance tests within less than 10 minutes. CBIAS consists of a head-mounted computer-driven display with discrete-element eye tracking technology, a sensorized platform, and a laptop for control, data analysis and display. The system is readily transportable, moderately rugged, and does not require special setup provisions. The test sequences are entirely computer-controlled and require a minimum of operator training.
The traditional diagnosis of mTBI, based on clinical interviews and inferential methods is complicated by its symptomatology: sleep problems, fatigue, irritability, headache, nausea, dizziness, blurred vision, confusion, fatigue, poor concentration, memory problems, and noise or light intolerance. The first three conditions alone have very high base rates in the general population of 29%, 27%, and 20%. In addition this symptomatology is almost identical to that found in PTSD, further diminishing discrimination capability.

Other approaches have sought to develop quantitative measures using eye movement accuracy as well as stance stability assessments, since the cranial nerves associated with eye movement and stance control are very sensitive to even “low level” cerebral injury. In addition, since cranial nerve damage is associated with physical trauma, deficits in these quantitative measures should be associated with mTBI, as opposed to PTSD. While statistical differences between concussed and normal populations were established, none of the approaches have yielded an assessment device/system trustworthy enough to make individual return to duty (RTD) decisions.
REFERENCES


CBIAS PROTOTYPE IN ACTION

Prototype Version of the CBIAS
(Computerized Brain Injury Assessment System)
PILOT STUDY

Based on the results of pilot studies (n=46) at Fort Lee, Hunter VA and DVBIC Charlottesville, the primary reasons for failure to make accurate RTD decisions are as follows:

1. Previous approaches used either eye movement or stance assessment only. This is problematic in light of the large normal variabilities that we have observed. A much more promising approach is to integrate and complement assessments with both methodologies.

2. Particularly in the case of eye movement tests the aim has been to make diagnoses on the basis of single tests performed in a short period of time. This approach is not likely to be successful in light of the significant adaptation effects that we observe on the part of the subject, which frequently render first-test scores useless.

3. Another goal has been to establish absolute score ranges to distinguish normal and concussed populations.
CBIAS EYE TRACKING

Circular smooth pursuit of subject with no TBI history and good tracking
Circular smooth pursuit of subject with recent mTBI diagnosis
Circular smooth pursuit of subject with no TBI history and poor tracking.
PILOT STUDY

What our studies have shown is that, while some mTBI cases present with dramatically reduced eye-track capability and stance control, highly functioning individuals with no brain injury history can have raw scores that overlap with those of the concussed population. What nonetheless tends to distinguish concussed from such “poorly coordinated” nonconcussed subjects is the degree to which scores deteriorate from simple to challenging tests, particularly those involving both eye movement and stance control in tandem.
mTBI and normal discrimination with machine learning.

Specificity: 0.92
Sensitivity: 0.93
PILOT STUDY

Our data lends further support to the relevance of using test sequences and the methodology duality of the CBIAS assessment approach. This duality (visual, vestibular), the differential scoring approach, and the use of machine learning approaches that permit the multidimensional pattern analysis of test scores contribute to the results of pilot clinical studies with 46 subjects which suggest that the system is capable of distinguishing mTBI-induced neurocognitive deficits with a specificity /sensitivity of 0.92/0.93.

Another significant result of our clinical studies, which involved subjects with mTBI as well as mTBI/PTSD, is that it supports the previously stated notion that PTSD plays no discernible role in the observed stance and eye tracking deficits.
NEXT STEPS

Attaché-based unit with wireless capability and smart phone app
Continued protocol, data and algorithm development
Uses in military, sports and emergency departments
DVBIC CHARLOTTESVILLE REHABILITATION PROGRAMS – A CIVILIAN PARTNER OF THE DVBIC SYSTEM THROUGH 6/13