NEUROflow

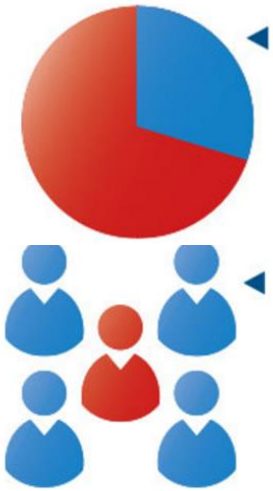
Guiding Diagnosis of Post Traumatic Stress Disorder & Traumatic Brain Injury

Team Leader / CEO: Christopher Molaro – Wharton MBA Candidate ’17
Product Leader / CTO: Adam Pardes– Penn PhD Bio Engineering

Clinical Problem	Current diagnostic methods are subjective and cannot readily distinguish PTSD from TBI leading to suboptimal treatment and ***Soldier Suicide***
Latest Research[3]	SPECT imaging revealed cerebral blood flow to be the first biomarker for specifically detecting PTSD, TBI, or PTSD+TBI
Technological Need	Quantitative image analysis software to guide PTSD/TBI diagnosis and appropriate treatment

Market Opportunity – Who is affected by PTSD/TBI & why does it matter?

PTSD Statistics



70% of adults in the U.S. have experienced some type of traumatic event at least once in their lives. This equates to approximately 223.4 million people

Up to 20% of these people go on to develop PTSD. As of today, that equates to approximately 44.7 million people who were or are struggling with PTSD.

*Image courtesy of PTSDUnited.org

- Nonpsychiatric direct medical costs, e.g., doctor and hospital visits, total ***$23 billion/year***—the largest component of the societal costs of anxiety disorders, ***including PTSD***.
- ***The majority of these costs*** are attributed to repeat use of healthcare services to relieve anxiety-related symptoms that mimic those of other physical conditions.
- People with **PTSD** have among the **highest rates of healthcare service use**. People with PTSD present with a range of symptoms, the cause of which may be ***overlooked or undiagnosed*** as having resulted from past trauma.

People with untreated PTSD/TBI[2]

→ **More likely to attempt/commit suicide**

→ **Higher rates of unhealthy behavior (e.g., smoking)**

→ **Struggle to maintain relationships w/spouses and children**

[1] http://www.sidran.org/resources/for-survivors-and-loved-ones/post-traumatic-stress-disorder-fact-sheet/
[2] http://www.rand.org/pubs/research_briefs/RB9336/index1.html

Veteran care presents a large market opportunity

- 5 mil Veterans are treated by military bases and VA Facilities annually
- A total of 723,143 recent combat Veterans sought VA care in the last 10 years
- Of which, 57% (412,192) either report or are diagnosed with mental illnesses and damages
- 185,437 Veterans were exposed to blasts and were diagnosed with TBI
- 5,248 Veteran TBI Clinical Diagnosis Tests were Inconclusive or "Unknown"
- Misdiagnoses result in an average $473 in extra costs per patient annually

Initial Total Addressable Market: $2.4 Billion

*The Veteran market is only our first iterative opportunity – we plan to positively influence mental health and head injuries in athletics, accidents and everyday care

* http://www.publichealth.va.gov/epidemiology/reports/oefoifond/health-care-utilization/index.asp
* http://www.ptsdunited.org/ptsd-statistics-2/
* http://www.publichealth.va.gov/docs/epidemiology/TBI-report-fy2013-qtr4.pdf

A Concrete Approach to Ensure Clinical Success

Neuro Flow's Three-Point Strategy:

1. Increase accuracy and confidence of diagnosis by physicians
2. Get patients the correct treatment for their disease + improve quality of life
3. Decrease healthcare costs associated with mis- or lack of diagnosis

Offering *quantitative*, *informative* data and images to help PTSD and TBI Diagnoses

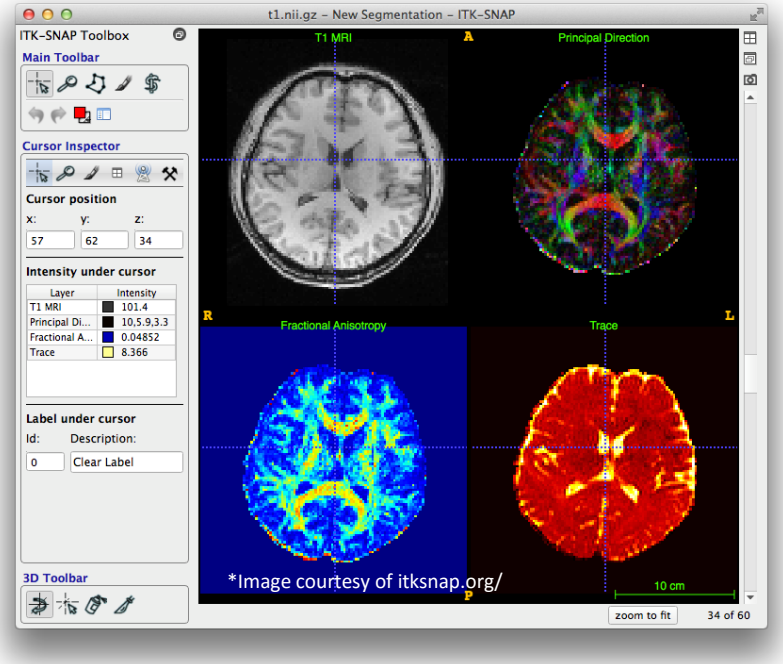


*Image courtesy of itksnap.org/

UPenn ANTs Image Registration and Segmentation:

- Award-winning algorithms[4] → Accurate and efficient
- Validated system and algorithm → No development needed
- Multi-modality ready → Combine SPECT and MRI images for functional and anatomical insight
- Compatible with powerful statistical analysis programs and tailored for big data
- No patents related to SPECT/MRI for PTSD and TBI diagnosis
- Application is extremely new and ripe with opportunity

[4] http://stnava.github.io/ANTs/

Execution Plan

Timeline

Sept 2016 – Perform IRB-approved analysis of brain scans to demonstrate clinical efficacy. Apply for patent covering SPECT/MRI image analysis for diagnosing PTSD/TBI.

Funding: Personal and family/friends

Dec 2016 – Complete development of user-friendly software interface. Submit 510K notification to FDA for Class II device approval.

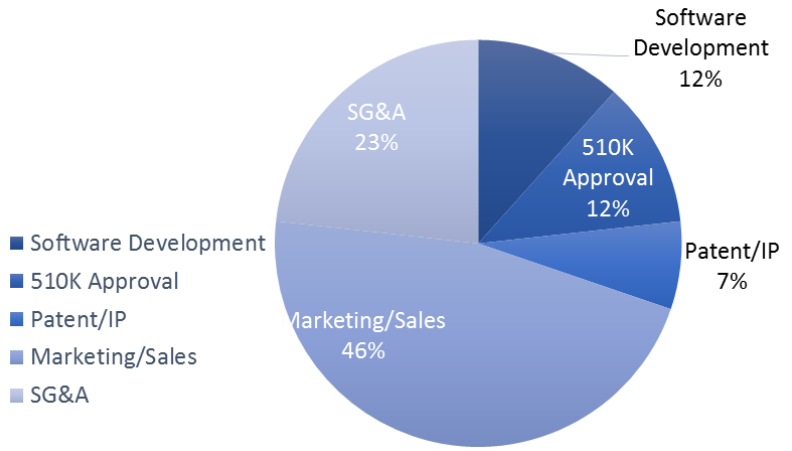
February 2017 – Beta test the software platform with UPenn Hospital and the Philadelphia VA Hospital.

Funding: Angel funding

Initial 6 month cost breakdown:

- $25K / Software development
- $1K / facility installation and trouble-shooting
- **Other:** $25k/510k Approval, Patents, SG&A

Total projected cost breakdown (after prototype launch):



The Team – Who is Neuro Flow?

Chris Molaro

Chief Executive Officer: Oversees all business/finance operations
Wharton MBA Student, West Point Graduate, US Army Combat Veteran
Co-Founder of Veteran Non-Profit Organization (Things We Read, Inc.)

Adam Pardes

Chief Technical Officer: Oversees all medical/technical operations
Bioengineering PhD Student, InSITE Fellow and AVP Operations
President, Biomedical Engineering Society (UPenn Chapter)

Consultants:
Technical: Long Xie (Registration/Segmentation Expert), Brian Avants, PhD (Developer of ANTs Software)
Clinical: Jacob Dubroff, MD (Radiologist, SPECT Expert)
Regulatory/IP: Trude Amick, PhD (Licensing/IP Advisor), Caitilin Hamill, PhD (Former FDA Regulatory Officer)

Near Term Hire:
Software Developer: We have identified a need for assistance in building an attractive and user-friendly interface for Neuro Flow that facilitates a streamlined experience for physicians

Medium Term Hire:
Clinical Partner: Physician to be the pioneer of this technology in the clinic and at medical conferences.
Legal Expert: Lawyer with medical device experience to help secure a strong proprietary position and foster future merger/acquisition by a large company

Long Term Hire:
Sales/Marketing VP: Liaison between Neuro Flow and hospitals, military, sports teams, insurance companies, etc. to further promote our brand and incentivize rapid clinical adoption