

KidsBrainIT & IMPACT-ACE: Data Informatics Improvement Research in Pediatric Critical Care – Concept, Challenges, Co-ordination, & Future Collaborations

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Concept:

Routine Physiological Monitoring

- Clinical use in PICU
- At least minute resolution
- Net-worked or non-networked monitors



Concept:

Physiological Data Beyond Clinical Care

Audit & Research

- Variable and unit dependent
 - High resolution data (at least minute resolution)
 - Lower resolution data (5 minutely resolution)
 - Low resolution data (e.g. end-hour recording)

Data archive & Storage

- Variable & unit dependent
- Forward planning required (e.g. High-resolution data compressed after 1 month)

Concept:

Closing the Data Loop

Making the best use of data generated through routine clinical care for research and quality improvement work

- Generate new research ideas
- Develop data-driven improvement interventions
- Improve patient care, outcome, and safety

Clinical Big Data, Data Science, Research, Innovation



Prof. JD Miller

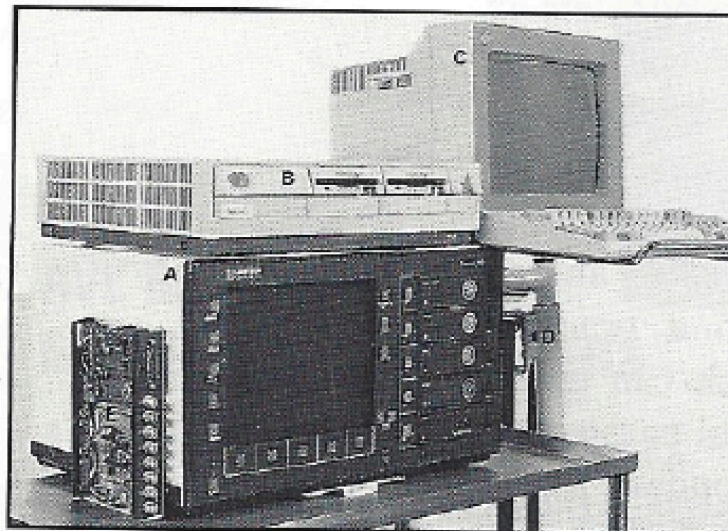
Brit J Intensive Care 1991, 1: 73-78.

COVER FEATURE

Computerised data collection

A Microcomputer Data Collection System in Head Injury Intensive Care.

IR Piper, PhD, A Lawson, HND, NM Dearden, FFARCS, JD Miller MD, PhD, FRCSE. Department of Clinical Neurosciences, University of Edinburgh, Scotland.



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BrainIT

(Dr. Ian Piper)



Brain Monitoring with Information Technology

- Adult brain trauma research collaboration in UK + Europe
- Established in 1997
- Clinicians, basic scientists, engineers, industry collaborations
- Improve the intensive care management and outcome of brain injured adults.
- Openness & free collaboration (NOT competition)



A New Multi-centre,
Multi-disciplinary,
Multi-national Data
Informatics
Paediatric Brain
Trauma Research
Initiative

(est. 2013)

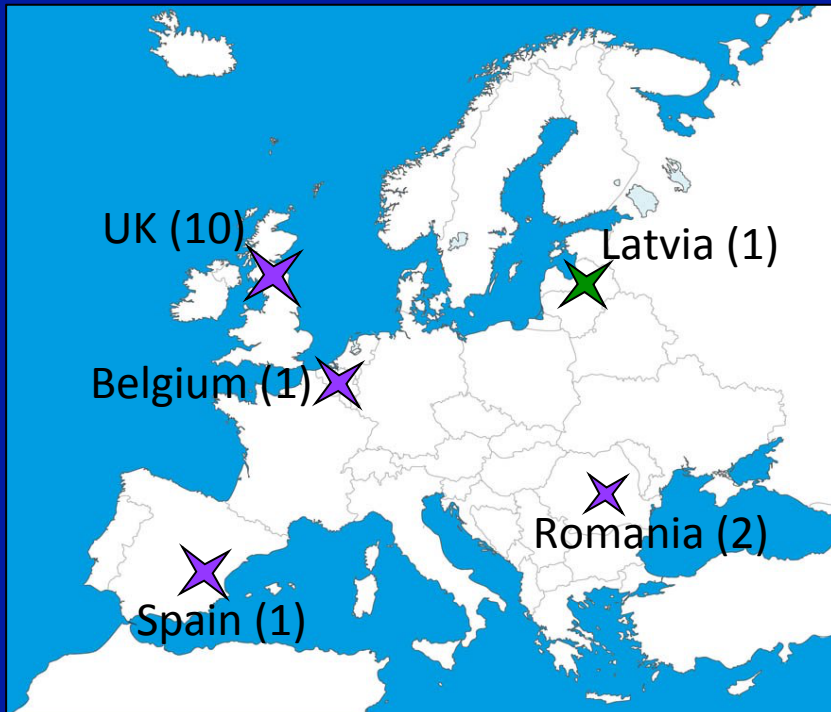
KidsBrainIT - Timeline

- Concept 2013 (Edinburgh led)
- KidsBrainIT launch, BrainIT meeting, Barcelona, Oct 2015
- Infrastructure development funding Sept 2016 (Neuroscience Foundation £11,220)
- Phase 1 funding secured Nov 2016
 - EU grant (ERA-NET NEURON)
 - 621,843 Euros



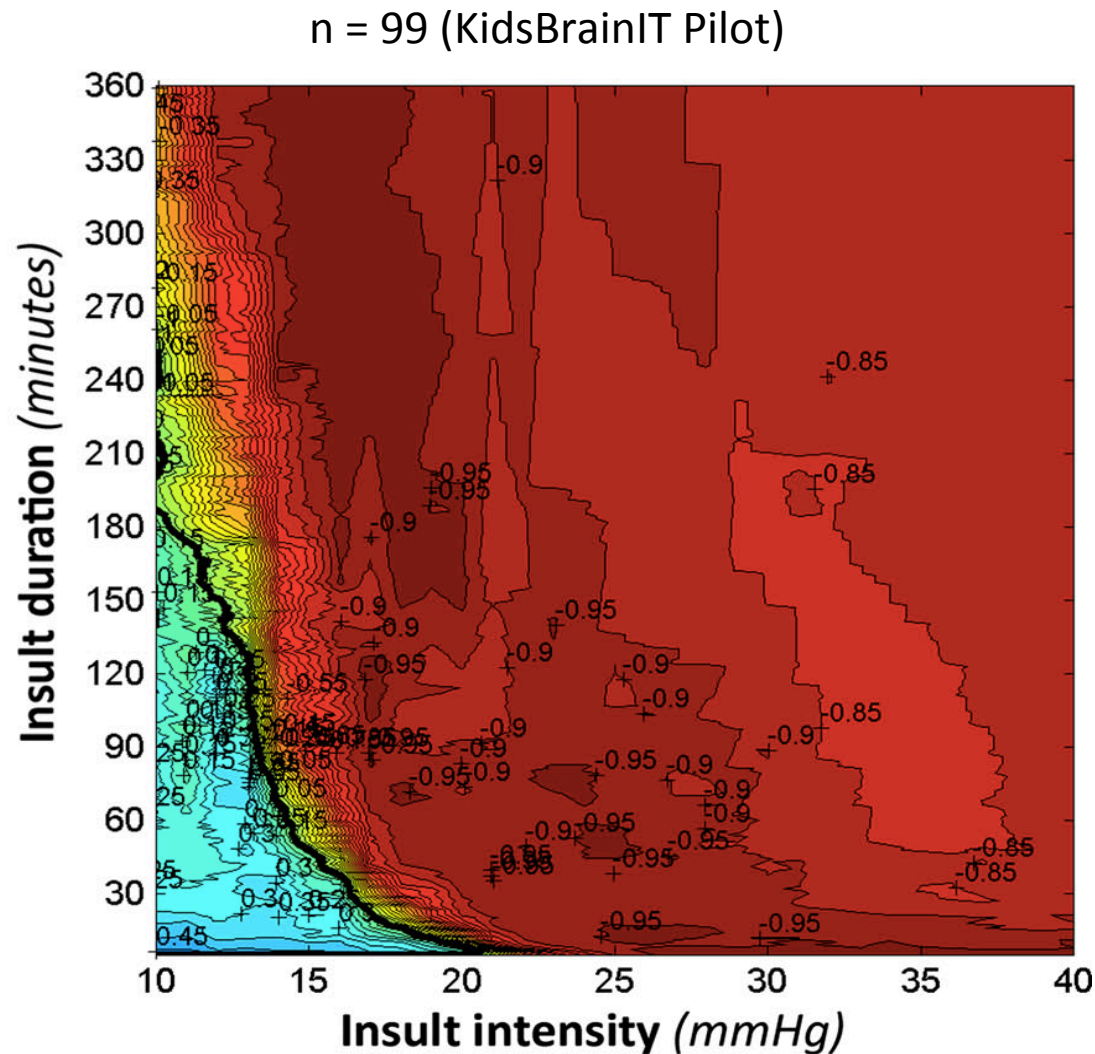
KidsBrainIT Phase 1

- Data collection started Nov 2017
- 15 PICU 5 countries

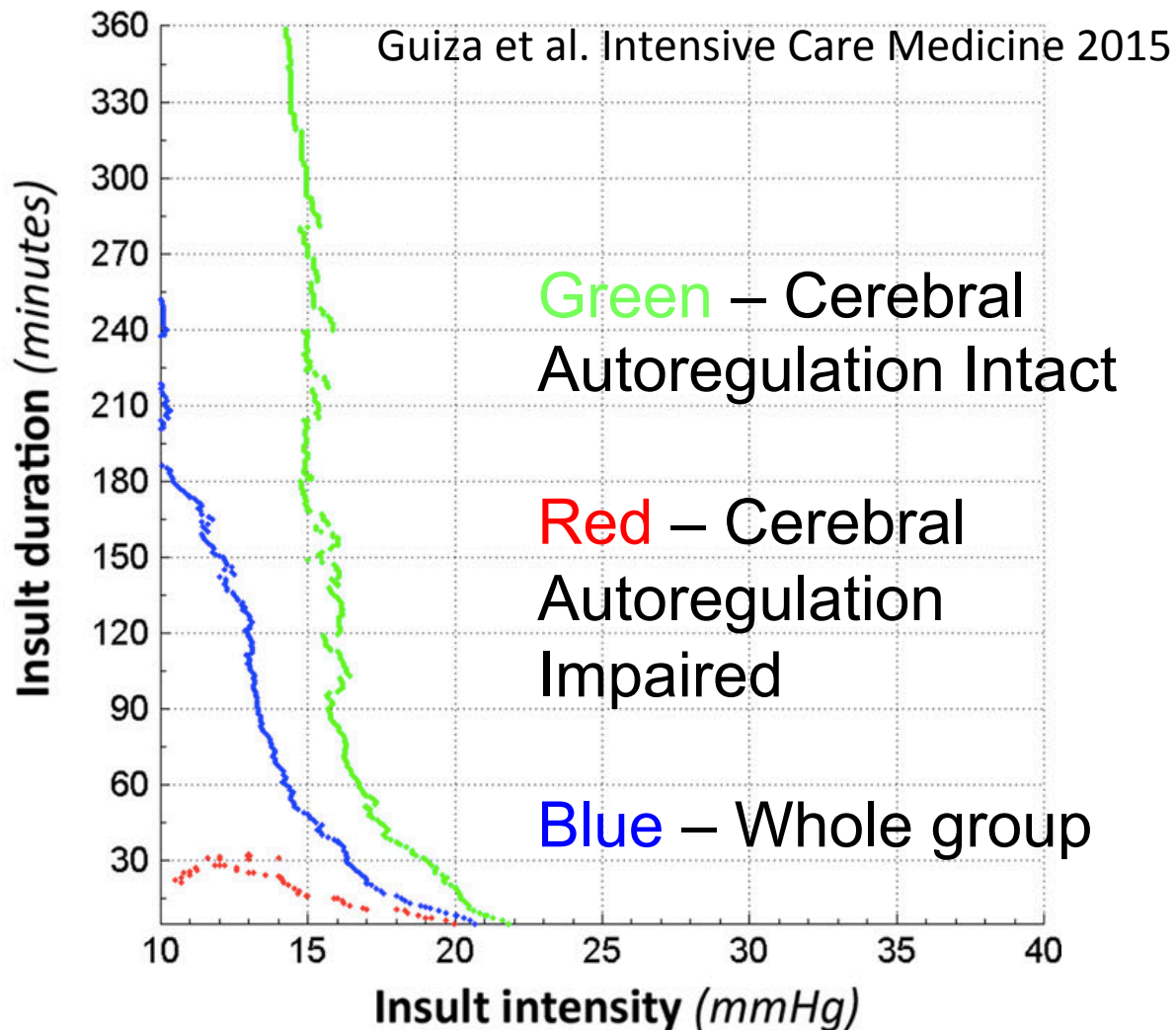


- Paediatric TBI (Clinical big data)
- Hypotheses testing (ICP dose response, cerebro-autoregulations & TBI recovery) (Data science & Research)
- Novel technology development sub-study (BCN & EDI) (Innovation)

ICP Dose-response Visualisation Plot



ICP Dose-Response & Cerebral Autoregulation Status



Challenges

- Multiple regulatory bodies in different countries (Ethics / R&D / Management)
- Bedside monitor data extraction – different brands + configurations
- Multi-centre multi-national technical support for study specific java tool + computers
- Outcome follow-up (some families are lost to follow-up)
- Novel technology substudy equipment matching fund
- Hospital move (delayed novel technology substudy timeline in UK)

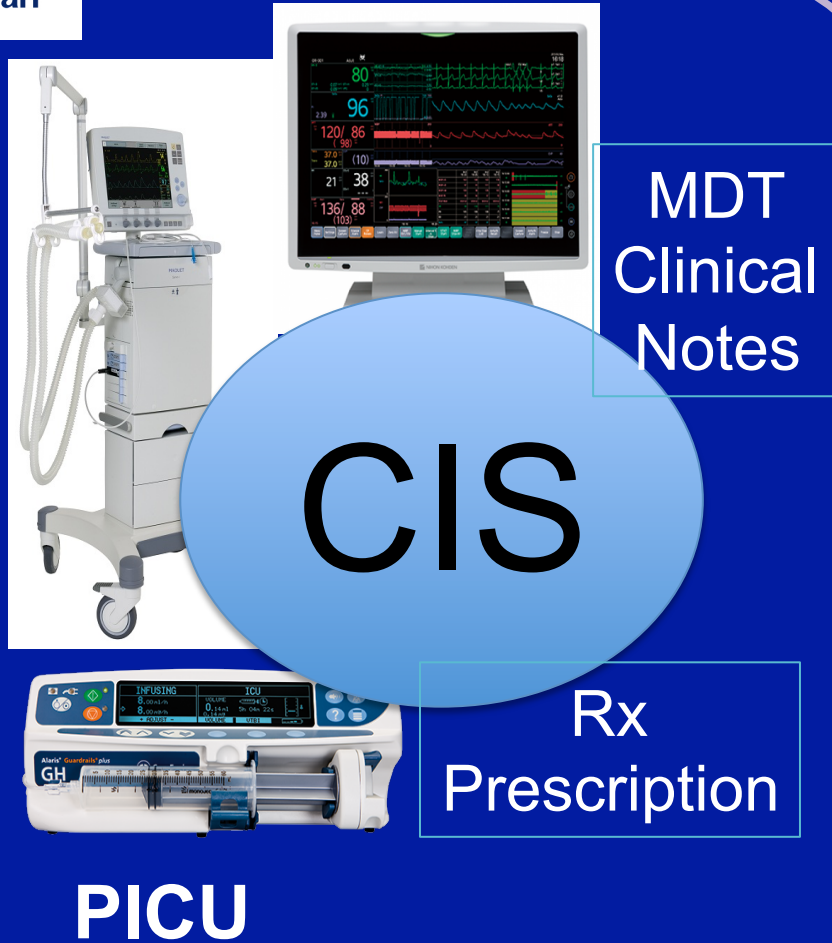
Co-Ordination

- Bespoke interface successfully developed for different monitor brands + configurations to extract beside monitor data
- KidsBrainIT Data-bank + infrastructure set-up within Usher Institute (Edinburgh)
- Novel technology substudy started in Spain, UK to join after hospital move
- Secured web-based data entry / transfer
- Further funding applications
- New collaborations (including industries)





IMPACT-ACE



**Data
Informatics
Improvement
Research**

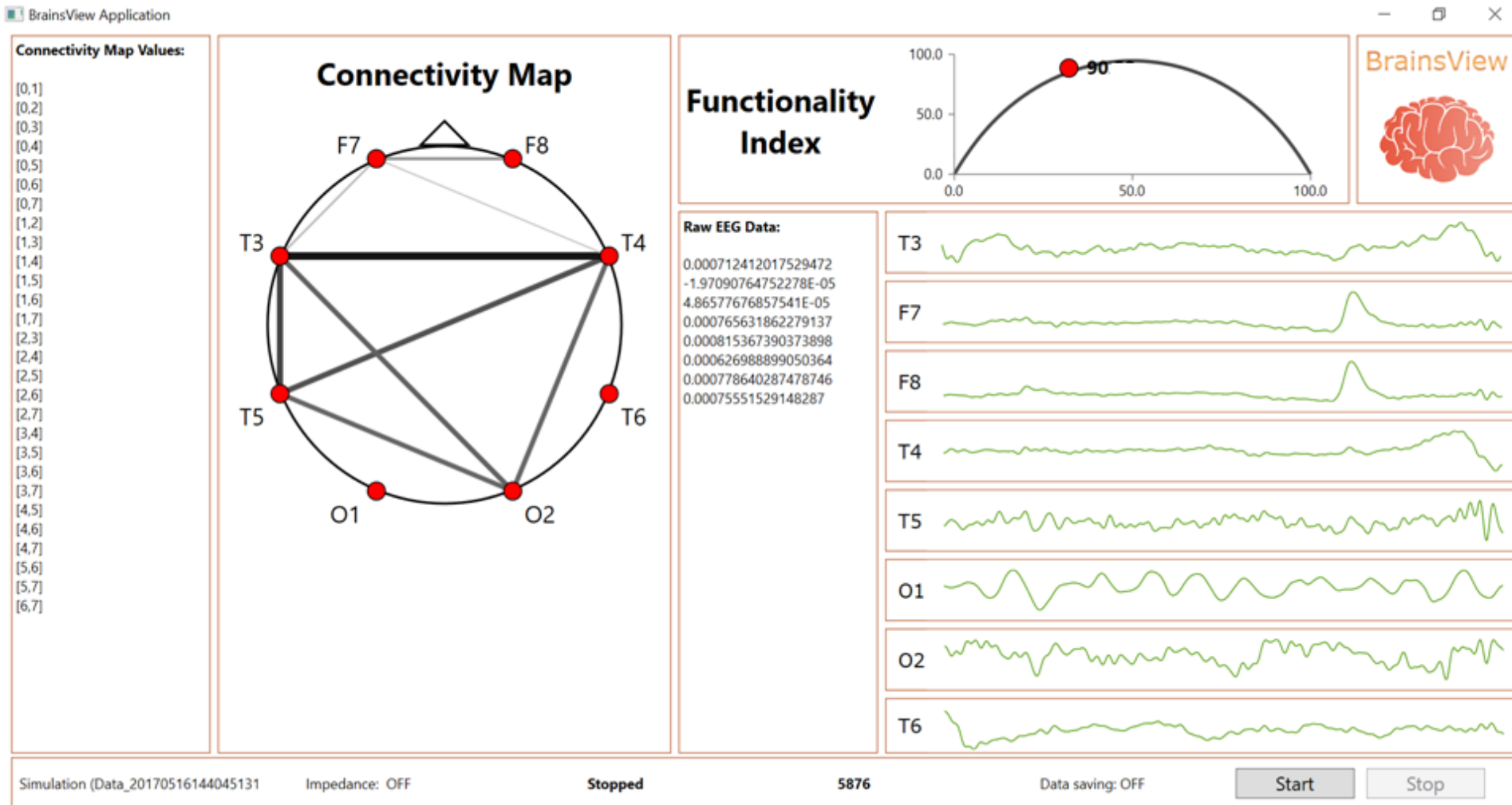


Future Collaborations

Clinical Big Data, Data Science, Research, Innovation

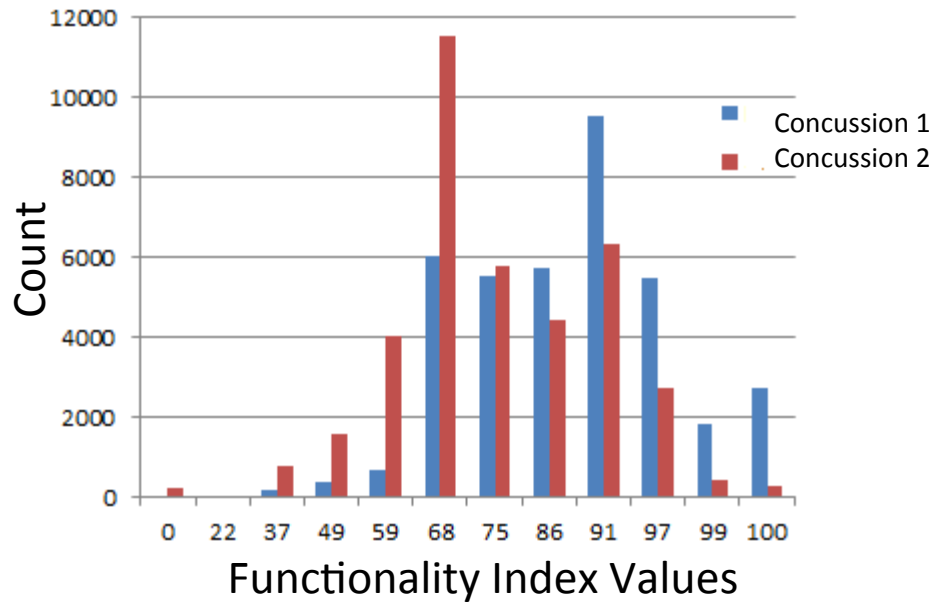
- MRC P2D grant
 - Academic – industry – clinical collaborations
 - Accelerate brain functional connectivity assessment & clinical translations
- IMPACT-ACE
 - National / International PICU Physiological data-bank for research + quality improvement
- MRC Precision Medicine PhD Studentship
 - Machine learning / AI / Data Linkage Collaborations
- KidsBrainIT Phase 2 (beyond UK + EU)

Analytic Software

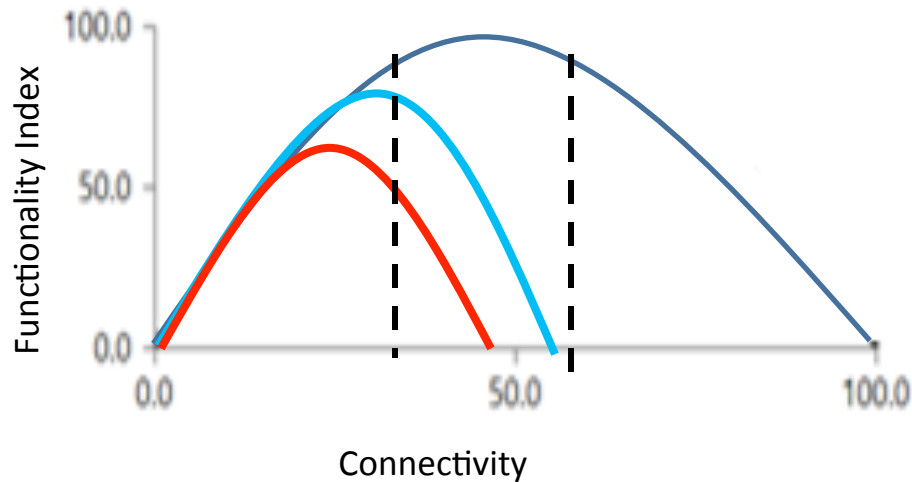


Functionality Index: x axis 0 to 100% connectivity, y axis 0 to 100% entropy of the system.

Concussion

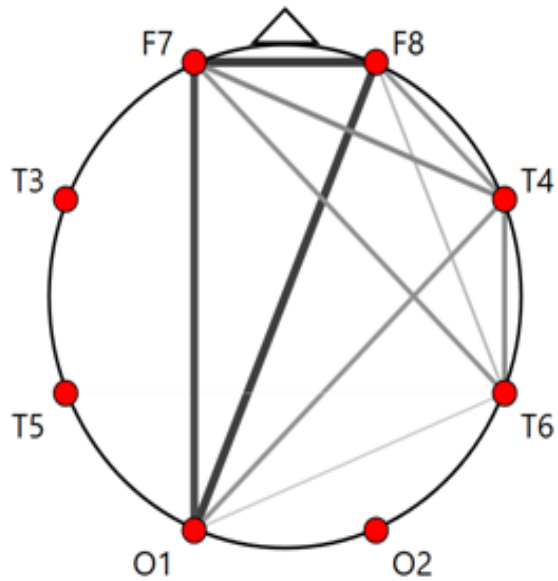


Maximal Functionality Index for Concussion patient 1: 91
Concussion patient 2: 68

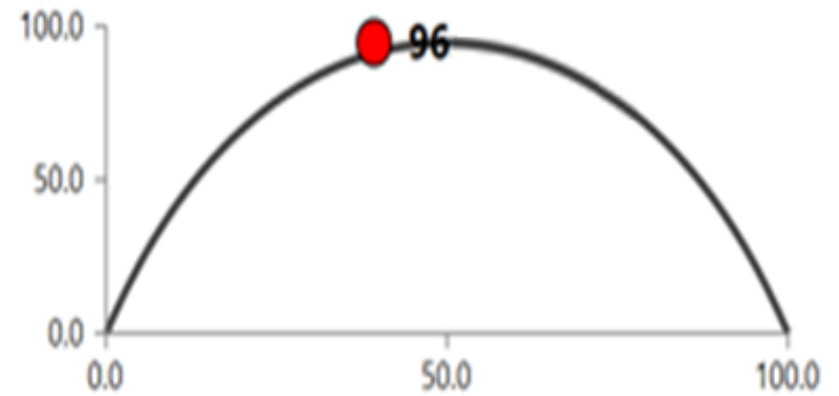


Maximal Functionality range values in normal, awake brain: 94 to 100

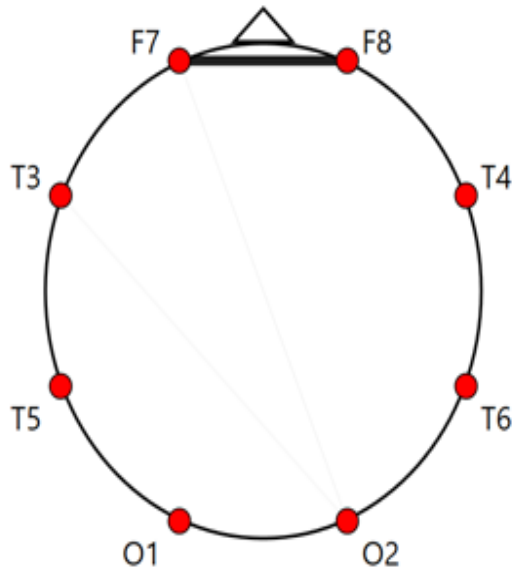
Connectivity Map



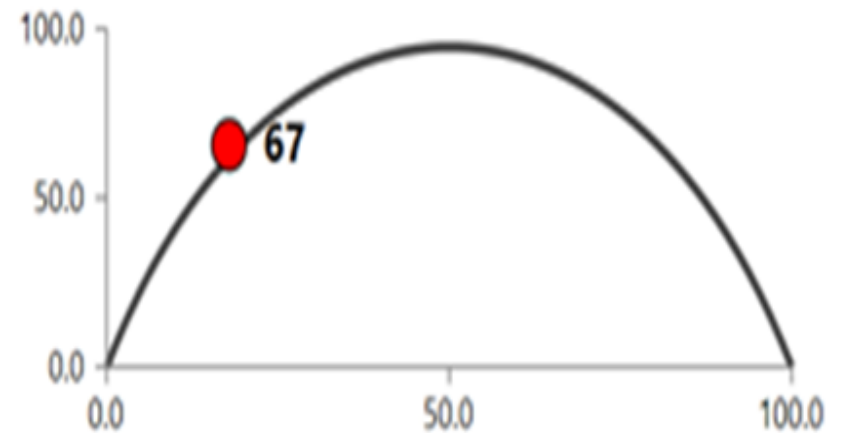
Functionality Index



Connectivity Map



Functionality Index



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- MRC Precision Medicine PhD Studentship
 - Machine learning / AI / Data Linkage Collaborations
- KidsBrainIT Phase 2 (beyond UK + EU)

Special thanks

- Ian Piper
- Patricia Jones
- R.A. Minns
- KidsBrainIT consortium partners (UK + EU)
- P2D Industry Partner (Brainsview Inc.)
- Funders:
 - CSO; NRS (Career Research Fellowship 2013) + NHS Lothian R&D (NRS Career Research Clinician since 2016)
 - ERA-NET NEURON
 - MRC
 - Neuroscience Foundation
 - Edinburgh Children's Hospital Charity