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
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.
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


- **Green** – Cerebral Autoregulation Intact
- **Red** – Cerebral Autoregulation Impaired
- **Blue** – Whole group

*Insult intensity (mmHg)*

*Insult duration (minutes)*
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

NHS Lothian

Usher Institute
Population Health Sciences & Informatics

PICU

CIS

MDT Clinical Notes

Rx Prescription

Data Informatics Improvement Research

THE UNIVERSITY OF EDINBURGH
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
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Clinical Big Data, Data Science, Research, Innovation

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- Patricia Jones
- R.A. Minns
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- P2D Industry Partner (Brainsview Inc.)

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- ERA-NET NEURON
- MRC
- Neuroscience Foundation
- Edinburgh Children’s Hospital Charity

KidsBrainIT & IMPACT-ACE Further information: mils.lo@ed.ac.uk