Swiss eHealth Summit
www.ehealthsummit.ch

Digitales Ökosystem
Gesundheitswesen –
Vorgaben umsetzen,
Versprechen einlösen
Smarter ICU
oder wie Analytics Lösungen den Betrieb auf der Intensivstation unterstützen

Emanuela Keller, Neurocritical Care Unit, Department of Neurosurgery, University of Zürich
Clinical Decision Making: EBM

- Clinical examination, imaging, lab
- Intensive Care: Multiple Biosensors
- Literature Search Rules for Classification
- US National Library of Medicine: 3000 publications/day

Cochrane
AHA, Circulation, 2006
Atkins, GRADE Working Group, BMJ, 2004
The Problem

- Data from multiple sensors and medical devices cannot be integrated

- Medical Device Companies: No open source system available

- Large number of false alarms in intensive care
  - 204 alarms per patient per day (Columbia NCCU)
  - Desensitization and delay of response time of ICU staff

- Increasing knowledge cannot be integrated anymore
Neurointensive Care

• Clinical assessment of consciousless patient → more biosensors

• Even more data from neuromonitoring
  • EEG alone: Tera-Bytes per day

• Secondary brain injuries due to small systemic derangements → high impact on cerebral hemodynamics & oxygenation
Neurointensive Care

«Neurocritical Care is a complex environment requiring data analysis that incorporates all interconnections and coupling between the organ systems»

1. Data synchronization and integration
   - Data on the flight
   - Lab data, imaging data...
   - Patient history

2. Data storage
   - Big data
   - Data protection

Fulfilled with EMR (PDMS)?
• Recapitulate the format of paper charts
• Data logging intermittently
• No waveforms
• No analytical power

Not fulfilled!
3. Data analysis
   - Development of algorithms
     - Understanding pathophysiology
     - Prediction of critical events, outcome
     - Decision support system
     - Real time...
   - Validation of algorithms with use cases

4. User-friendly data visualization and interaction
User-friendly GUI
Phase 1:
Data collection

Architecture

Monitor → Collector → Research Archive → Researcher

Patient → Doctor/Nurse → Live View

Treatment
Architecture

Phase II: Data analysis
Phase III: Integration of HIS

Architecture

Structured data: Patient history, Lab Images

Knowledge from scientific database

Monitor

Collector

Live View

Research Archive

Researcher

Patient

Doctor/Nurse

Treatment

AMALGA

Molis

KISIM

Synedra

HIS
Architecture

Phase IV: Data analysis

Monitoring

Doctor/Nurse

Collector

Live View

Live Eval

Predictive View

History View

Knowledge from scientific database

Research Archive

Structured data: Patient history, Lab, images

Patient

Treatment

Researcher

Modeler

ICU Cockpit

HIS

Knowledge from scientific database

AMALGA

SAP

KISIM

Synedra

HIS

ICU Cockpit
Graphical User Interface

Data View

History View

Live View

Predictive View

statistics

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ICU Cockpit
Clinical Study

• Primary Objectives

1. Implementation of additional sensor signals via interface of external monitoring devices

2. Implementation of video streaming

3. Improvement of signal quality by automatic artefacts detection & elimination
Clinical Study

Secondary Objectives

D & V of learning algorithms for

1. adjusting the settings of the artificial ventilation to individual patients
2. prediction and detection of cerebral vasospasm
3. prediction and detection of intracranial hypertension
4. prediction and detection of epileptic seizures
5. To integrate patient data from multimodal monitoring, electronic medical records and imaging with best medical evidence published for recommendation systems for clinical decision making
Partners

- Computer Vision Lab
- Data Analytics Lab

University of Zurich

University Hospital Zurich

Gebert Rüf Stiftung