A Care Assessment System to Support Community-Based Healthcare

Mohan Karunanithi, Antti Sarela, Justin Boyle, Niranjan Bidargaddi, Anthony Maeder

E-Health Research Centre, CSIRO ICT Centre, Brisbane, Australia

CSIRO

Queensland Government

E-HEALTH RESEARCH CENTRE

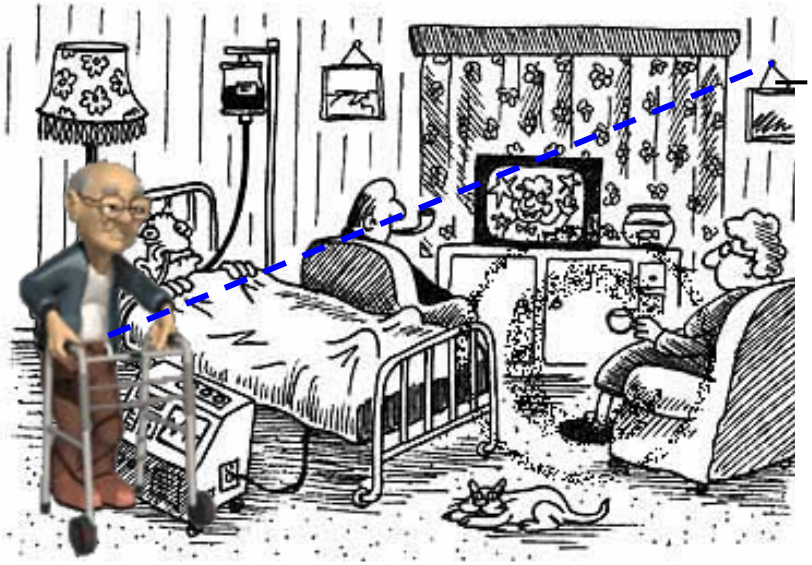
Background

- Pressures on health care delivery models because of:
  - Ageing population
  - Prevalence of chronic diseases
  - Diminished workforce

-> **Solution to improve care process :** Community based health care setting including multi-disciplinary care teams and detailed care plans

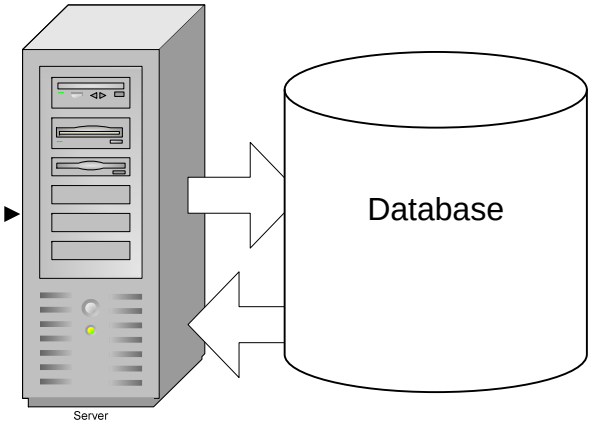
- Requirements:
  - Patient's health data should be collected and monitored also at home
  - Information on patient's health status should be available to care personnel at any time also outside the normal care circle

-> **Technology solution:** Software platform that provides monitoring and assessment information to the care team in the community care environment



Patient monitoring at home

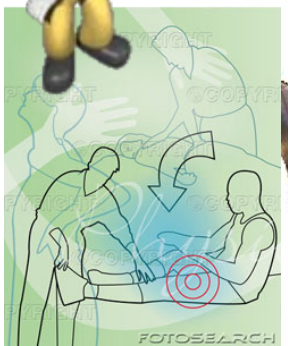
Health data transfer



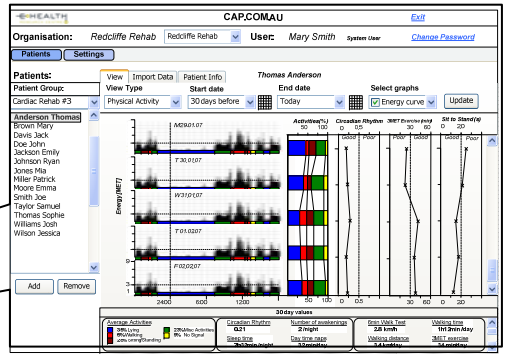
Centralized Server for data processing and storage

Community-based Healthcare

Assessment of patient condition and treatment



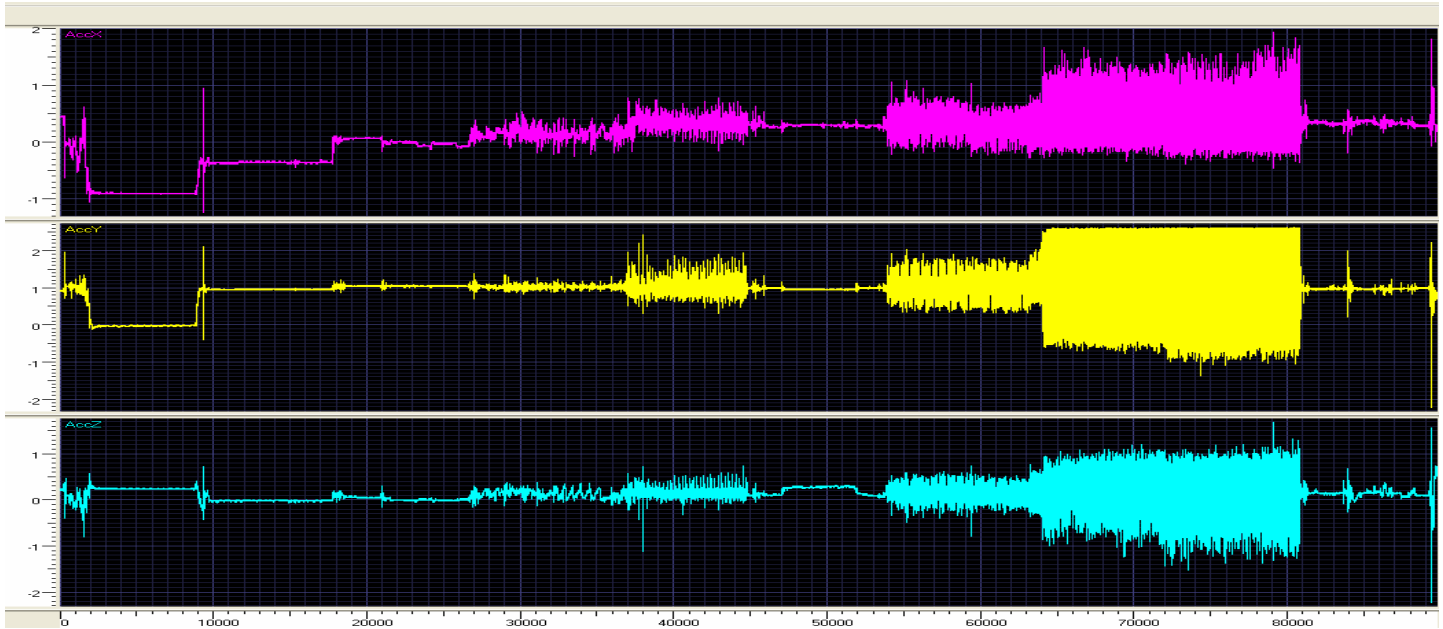
Web based GUI to display relevant health information to the care team



Methods

- Development of software platform technology that provides:
  - Ambulatory monitoring capabilities to collect patient data at home
    - Accelerometer, heart rate, and other health data
  - Calculation of clinically significant measures from the measured data to enable health assessment of the patients
  - Continuous availability of the measures for assessment to be performed at different time points and to monitor patient's progress according to their care plan
- Clinical trial to develop measures to assess patients with chronic diseases such as Cardiovascular Disease (CVD) and Chronic Obstructive Pulmonary Disease (COPD)
  - Trial employs ambulatory monitors worn by the patients to measure their physical movement activity and ECG
  - Measurement data is downloaded to a PC which analyses the data and displays clinically relevant information that the care team will use to assess the patient's condition

Ambulatory monitor: Waist worn accelerometer



Records X-, Y- and Z- axis acceleration

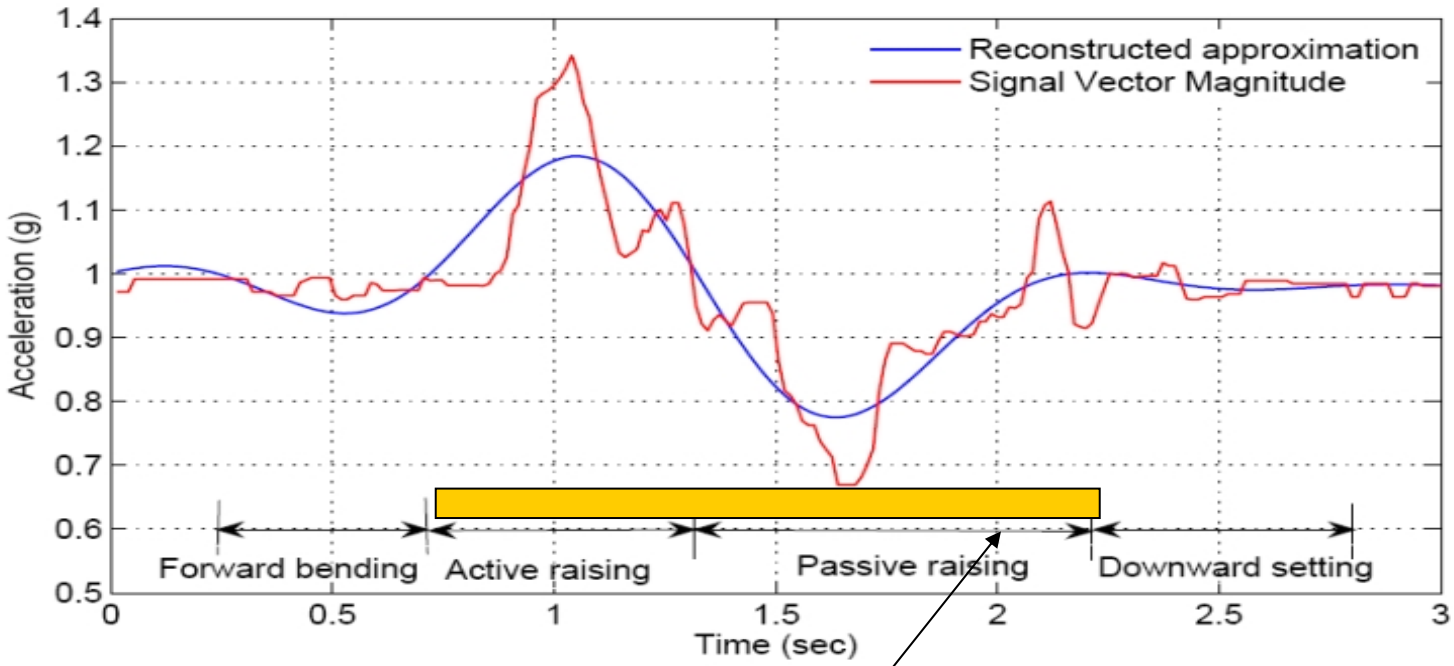
Movement patterns:

Sit to stand transition

Walking

Signal processing example

- Sit to stand transition duration can be calculated from accelerometer data by using wavelet transformation [1]



Transition duration

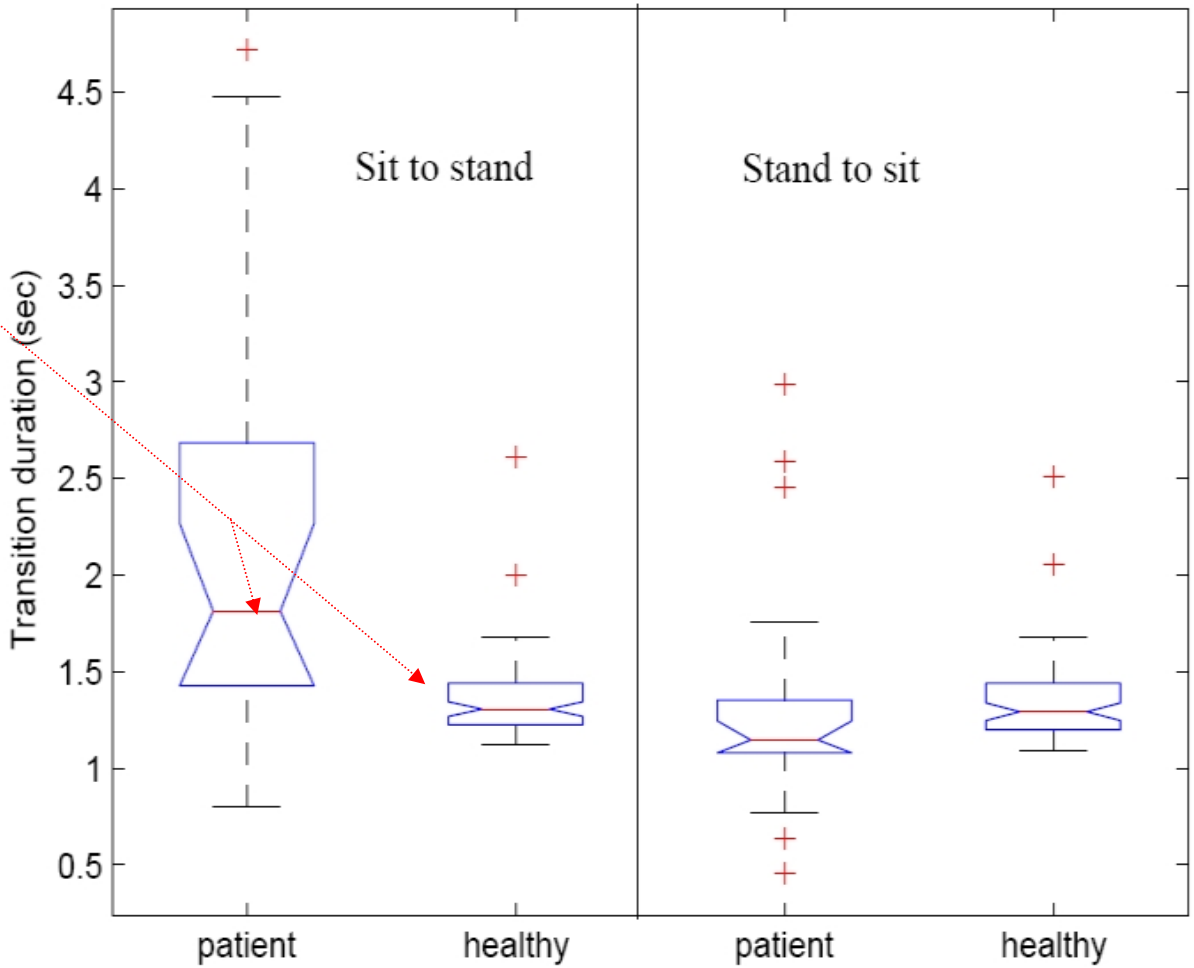
Transition duration significance

Sit to stand duration

- Statistically significant difference between healthy persons and elderly patients with medical conditions
- Sit to stand transition is also a good indicator to assess mobility of patients with heart diseases [2]

Stand to sit duration

- No significant difference observed

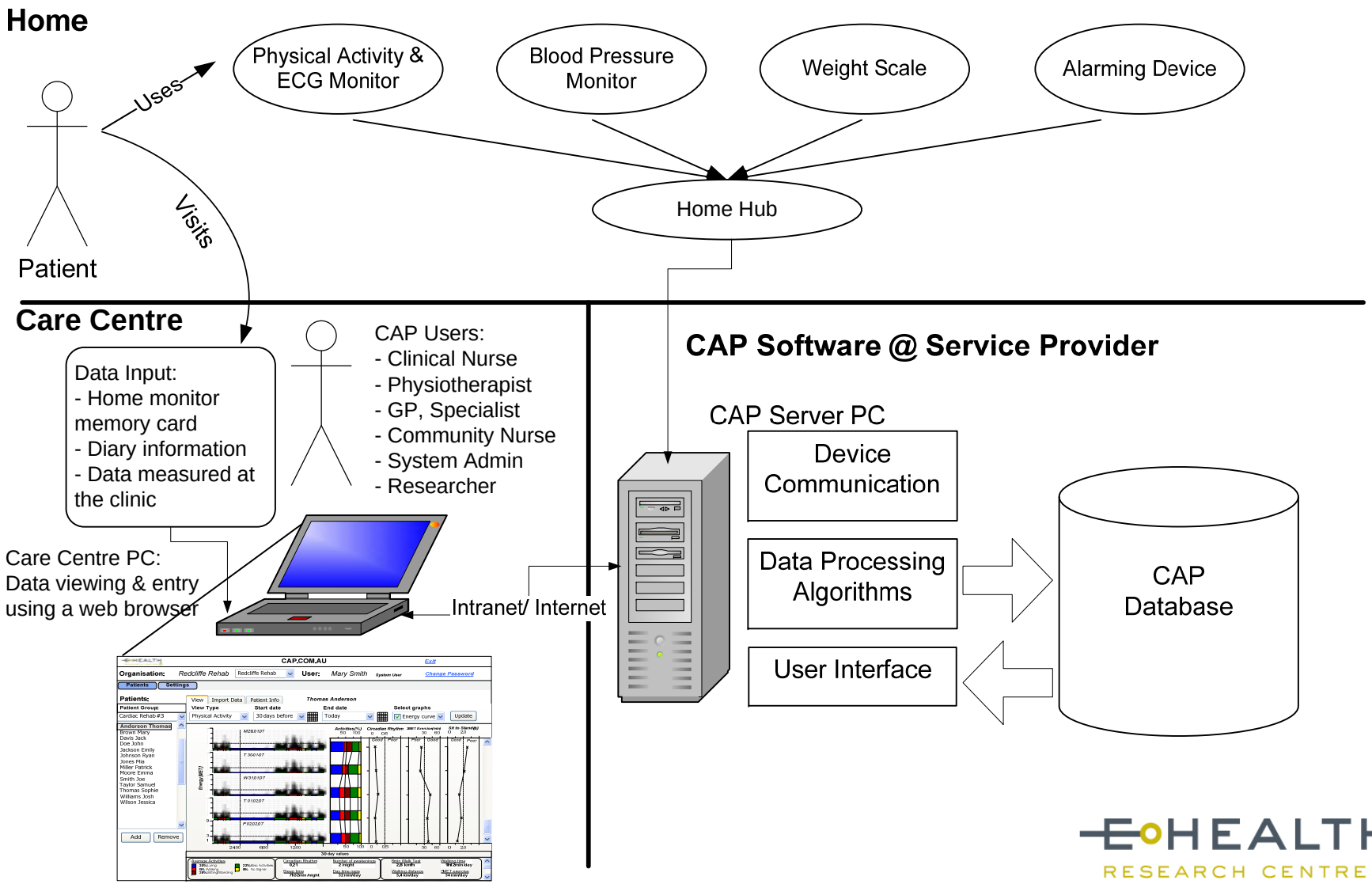


Data source: Princess Alexandra hospital, Brisbane

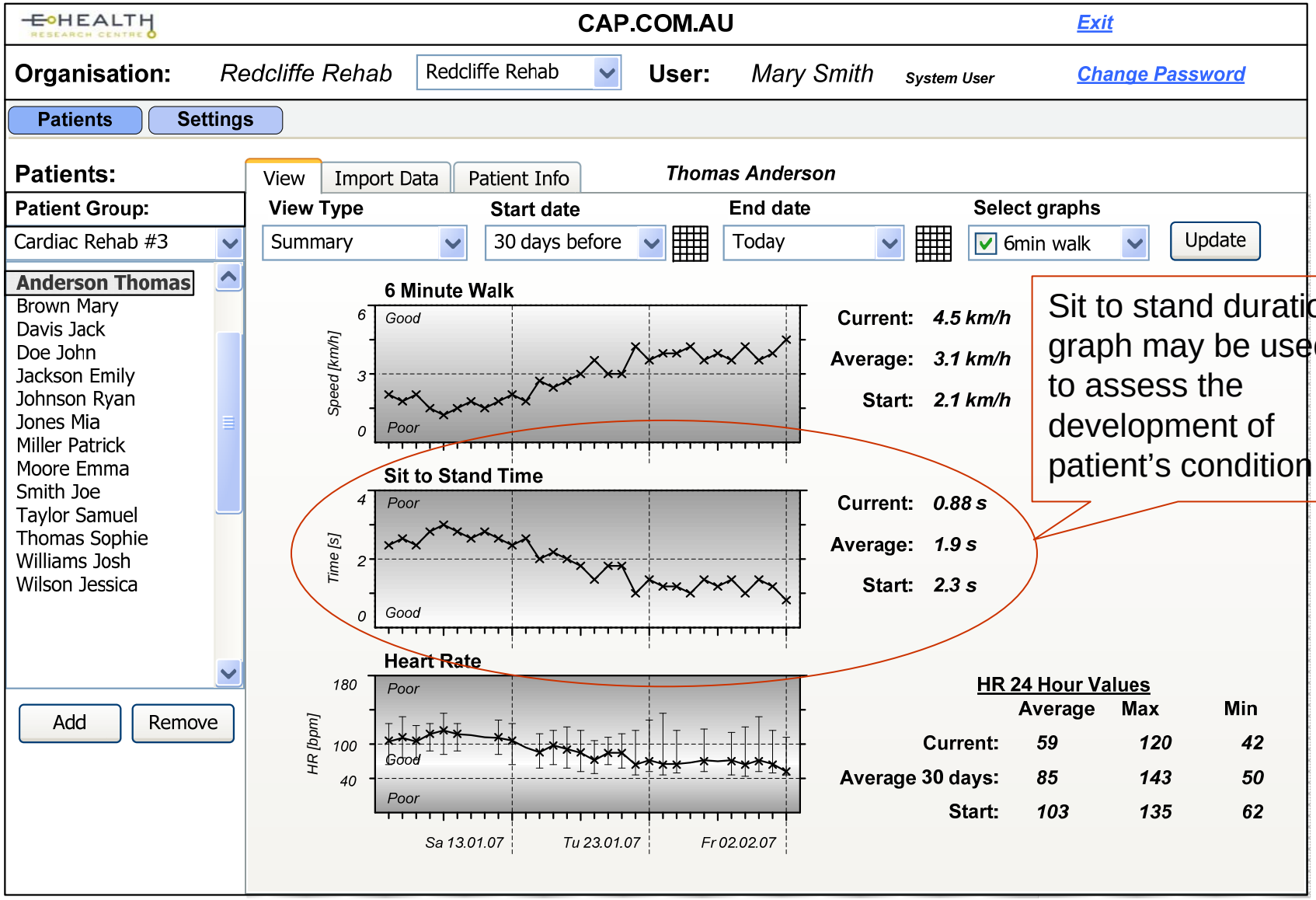
Care Assessment Platform (CAP) Software

- Main features
  - Convert and manage data form ambulatory devices fitted on patients
  - Perform data analysis to provide clinical measures that describe the patient's health condition
  - Store measurement data and related health information in a database
  - Provide a GUI for health care personnel to access the stored and analysed data
- Design principles
  - Open data exchange interfaces to connect various ambulatory monitoring devices
  - Highly modular structure to enable easy development of future applications and enhanced data analysis
  - GUI designed together with health care professionals to present clinically relevant information

CAP System Architecture



CAP GUI Summary View



Conclusion

- A care assessment software platform is being developed through a clinical trial conducted with ambulatory monitoring of COPD and CVD patients in a community care environment
- Clinical measures such as sit to stand transition time, metabolic expenditure and walking speed can be calculated and displayed to assist care team in assessment of patient's physical condition
- Future work:
  - Measure the effectiveness of the software platform in terms of health care benefits such as the ability to reduce hospital admissions
  - Incorporate the creation and monitoring of individual care plans to the software platform

References and contact information

[1] N. Bidargaddi, *et al*., Wavelet based approach for posture transition estimation using a waist worn accelerometer, 29th Annual Intl. Conf. IEEE Eng. Medicine and Biology Society, Lyon, 23-26 Aug 2007 (to appear)

[2] Claudia Mazz, *et al*., Biomechanic modeling of sit-to-stand to upright posture for mobility assessment of persons with chronic stroke, Arch Phys Med Rehabil, vol. 87, no. 5, pp. 635–641, May 2006.

Contact: Dr. Mohan Karunanithi, PO Box 10842,
Adelaide Street, Queensland, 4000, Australia

CSIRO

E-HEALTH RESEARCH CENTRE