

Smart Home Technologies in Dementia

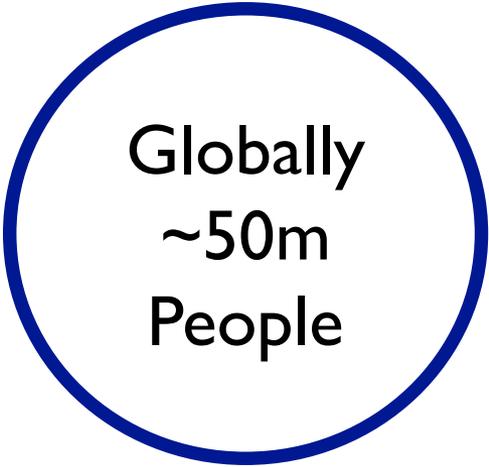
Payam Barnaghi

Centre for Vision, Speech and Signal Processing (CVSSP), University of Surrey

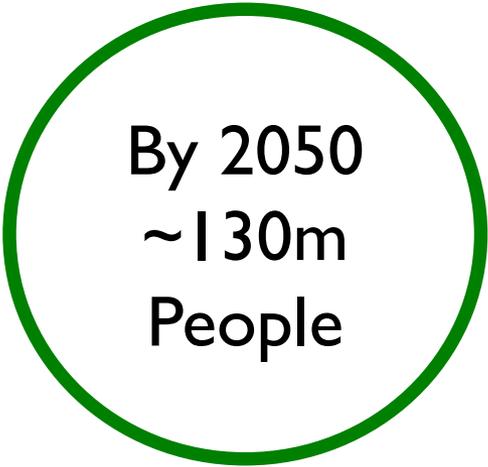
Care Technology & Research Centre, The UK Dementia Research Institute



One of the biggest health problem of our time?



Globally
~50m
People



By 2050
~130m
People



In the
UK, 1 in 4
Hospitals
beds



People with dementia typically spend £100,000 on the care they need – many spend much more



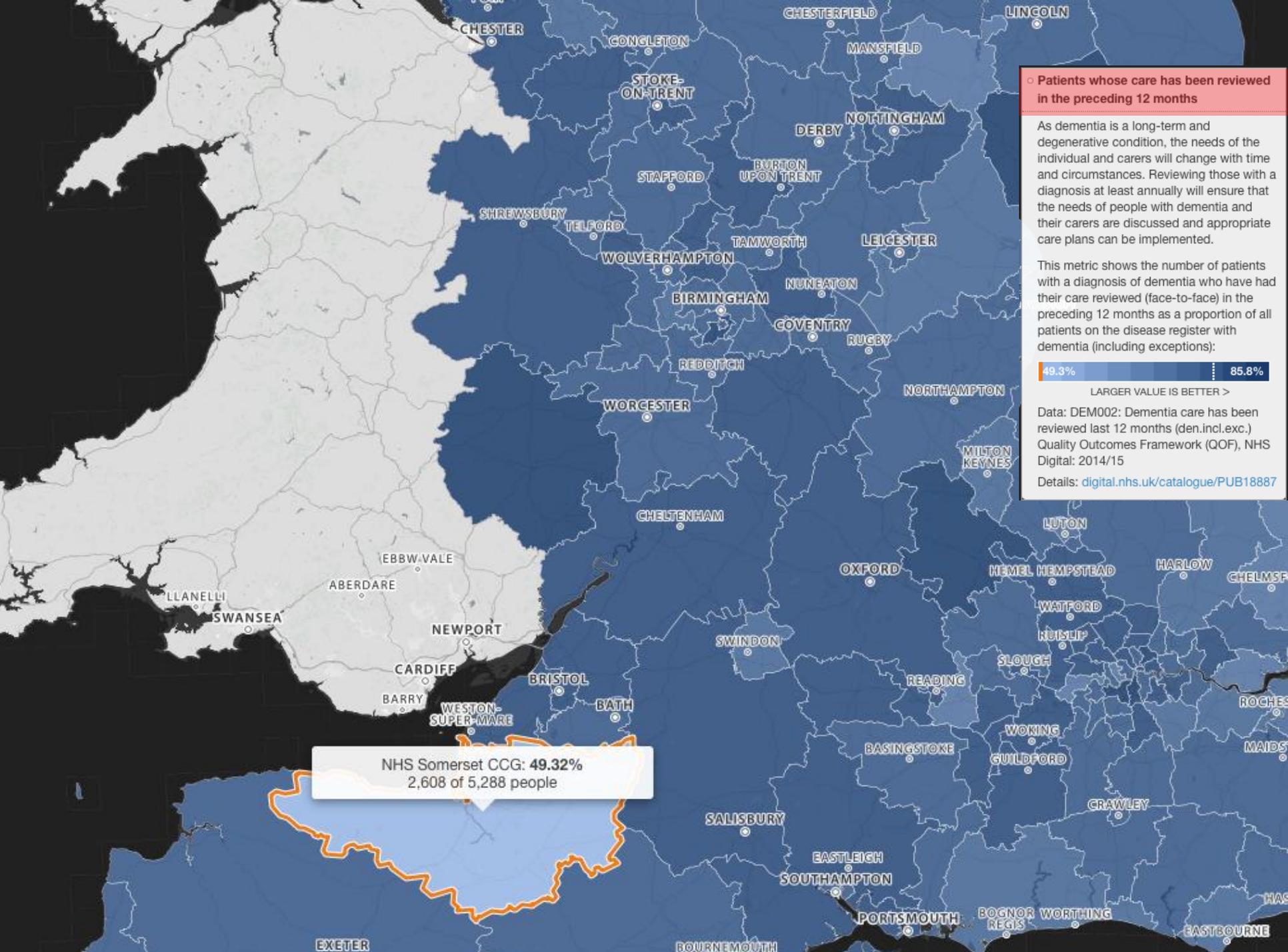
People affected by dementia shoulder two thirds of all dementia care costs in the UK



Dementia care can be up to 40% more expensive than standard social care



~22% of unplanned hospital admissions in people with dementia are due to preventable causes



○ Patients whose care has been reviewed in the preceding 12 months

As dementia is a long-term and degenerative condition, the needs of the individual and carers will change with time and circumstances. Reviewing those with a diagnosis at least annually will ensure that the needs of people with dementia and their carers are discussed and appropriate care plans can be implemented.

This metric shows the number of patients with a diagnosis of dementia who have had their care reviewed (face-to-face) in the preceding 12 months as a proportion of all patients on the disease register with dementia (including exceptions):



Data: DEM002: Dementia care has been reviewed last 12 months (den.incl.exc.)
Quality Outcomes Framework (QOF), NHS Digital: 2014/15
Details: digital.nhs.uk/catalogue/PUB18887

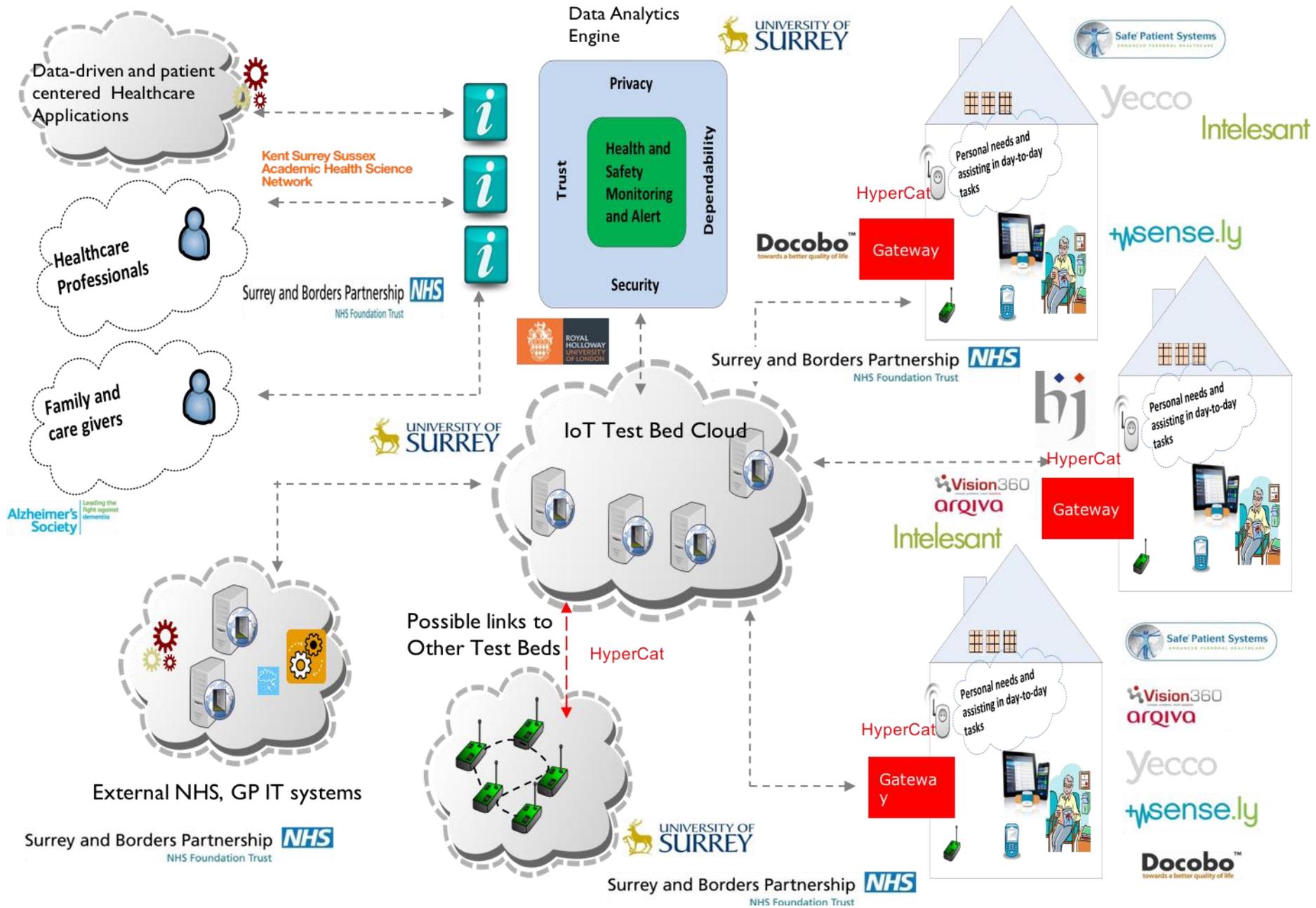
NHS Somerset CCG: 49.32%
2,608 of 5,288 people

How can technology help?



Surrey and Borders Partnership
NHS Foundation Trust



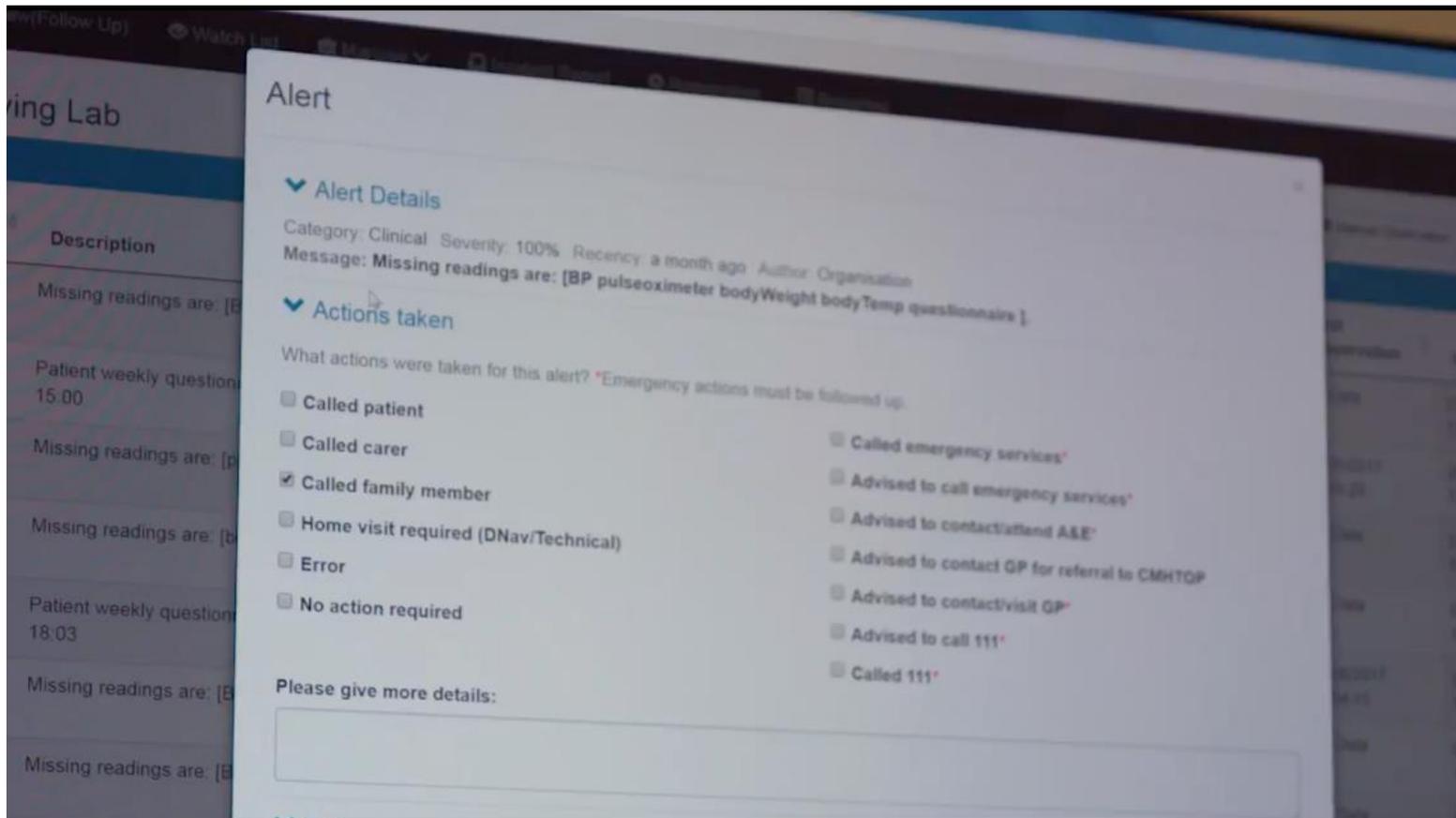


In-Home Devices





Integration

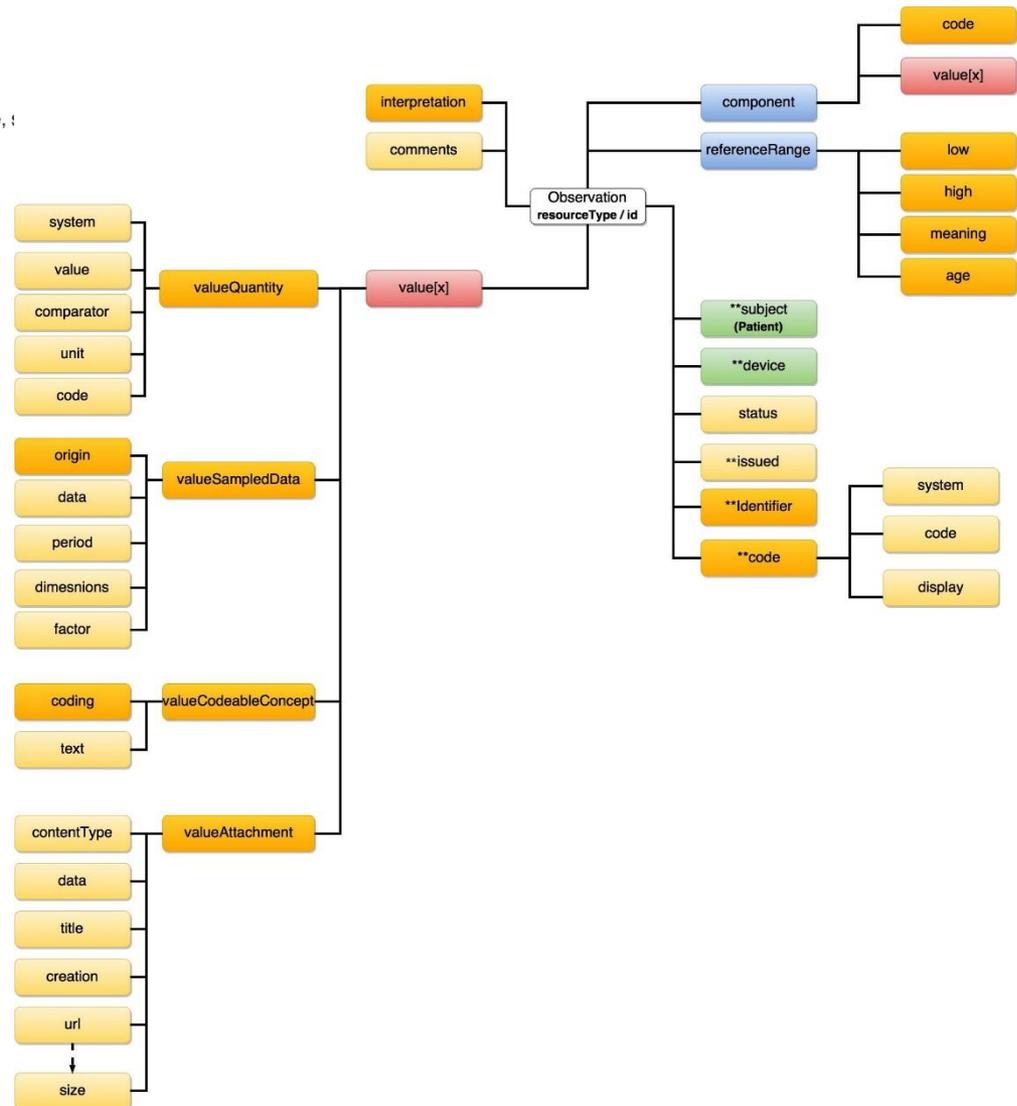


Interoperability: FHIR4TIHM and SNOMED codes

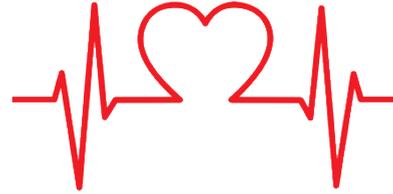
- **Observation - value[x] / valueQuantity:** Data which are represented as a single value, :

▼ Example (Room temperate)

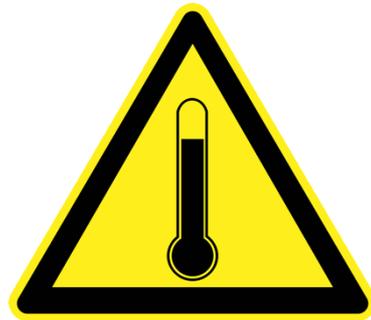
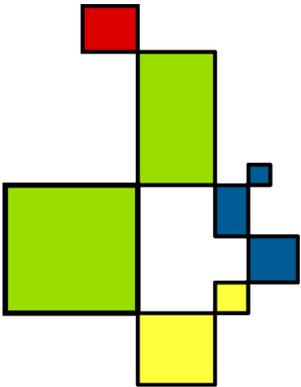
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  "entry": [{
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      }],
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      },
      "device": {
        "display": "Battery:90%-Location:Bedroom",
        "reference": "Device:CompanyA/UniqID1"
      },
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          "code": "60832-3",
          "display": "Room Temperature"
        }]
      },
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    }
  ]
}
```



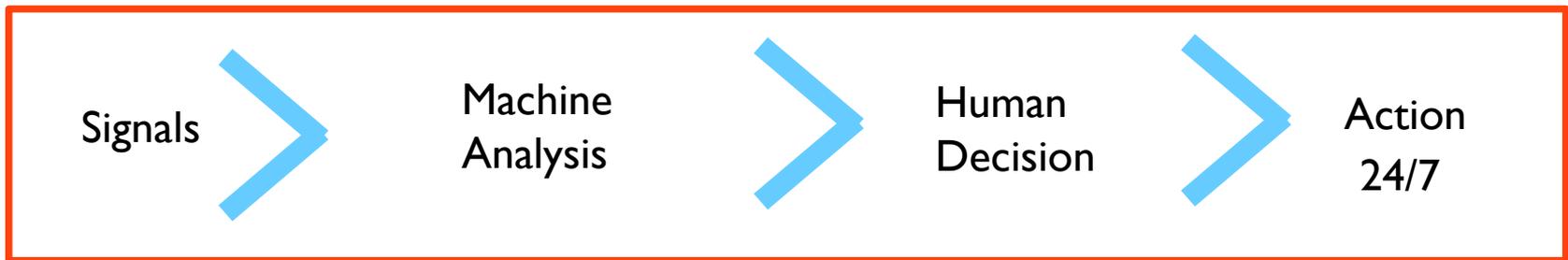
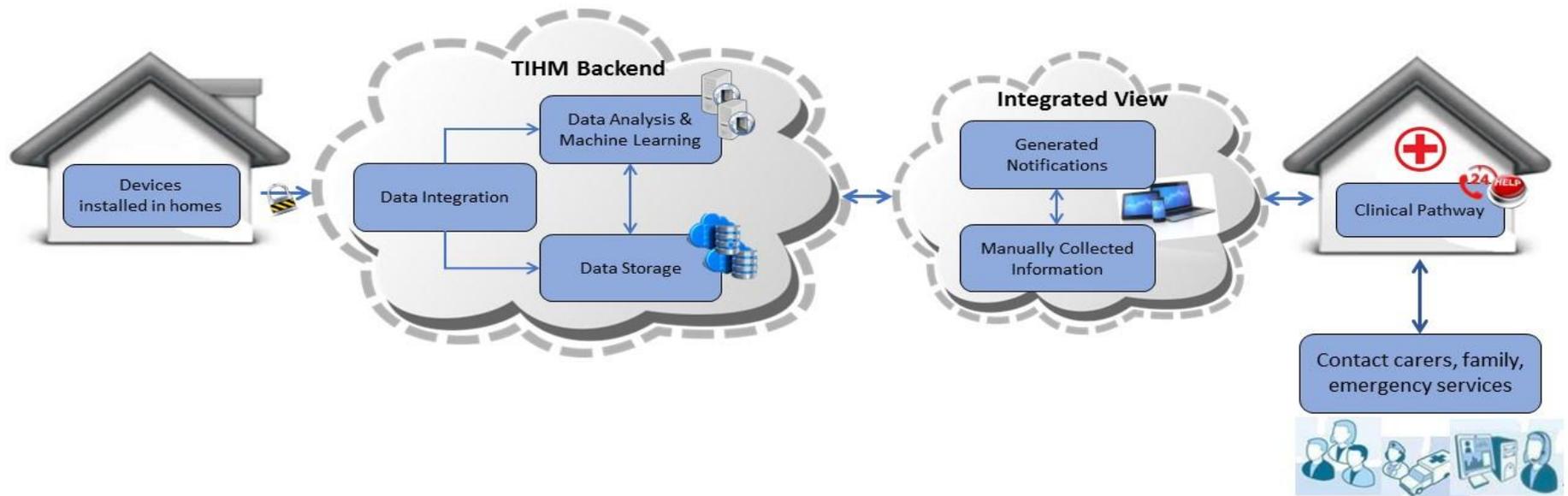
Physiological



Environmental

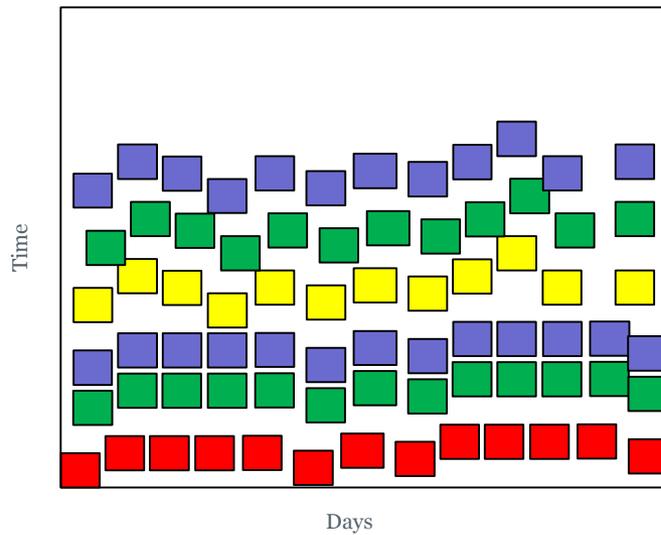


How does TIHM work?

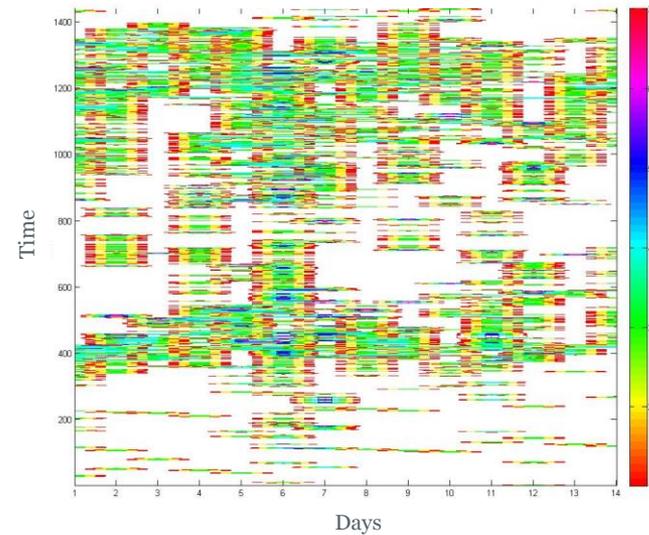


Daily activity pattern analysis

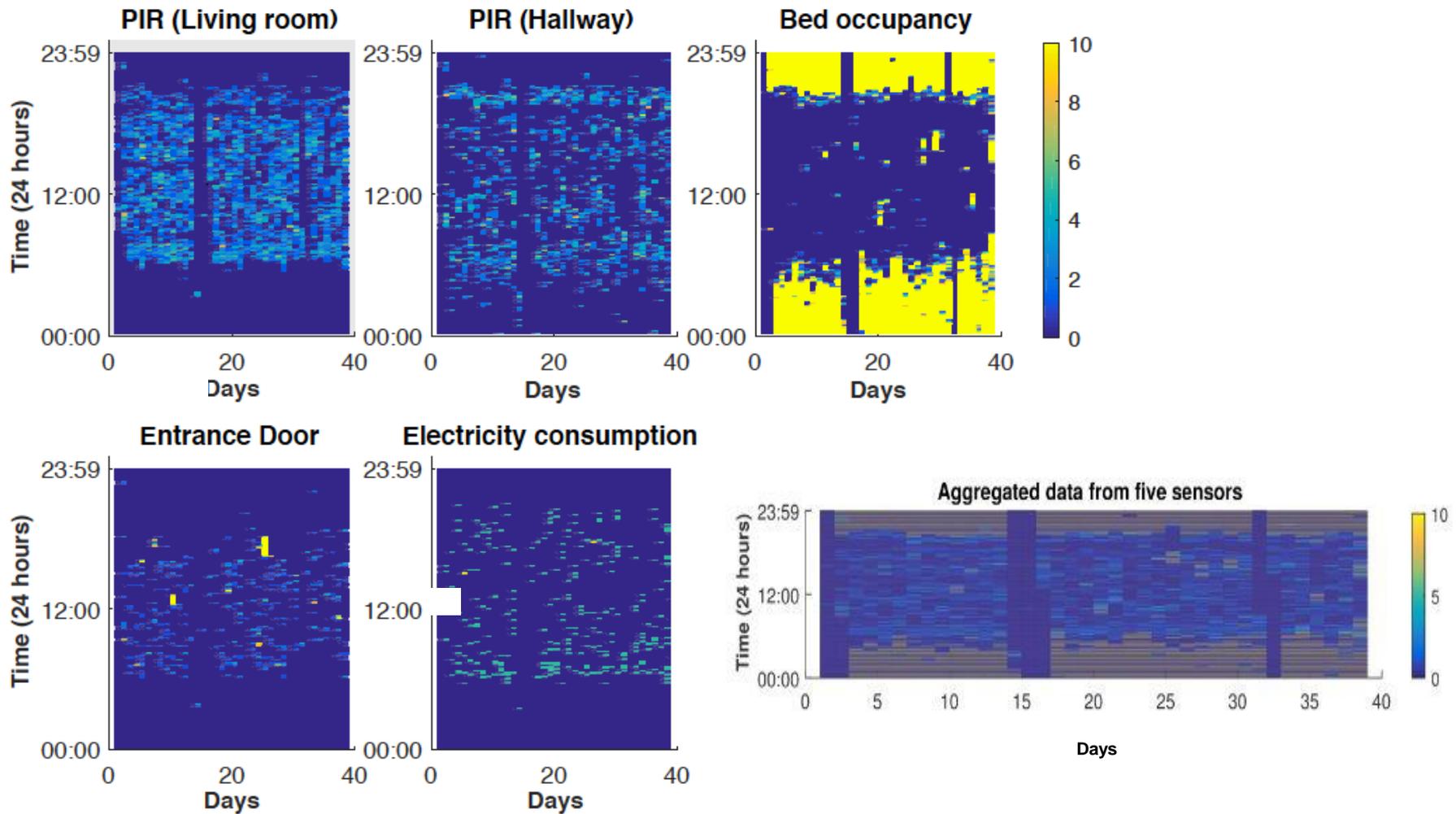
Aggregated daily pattern (2weeks)



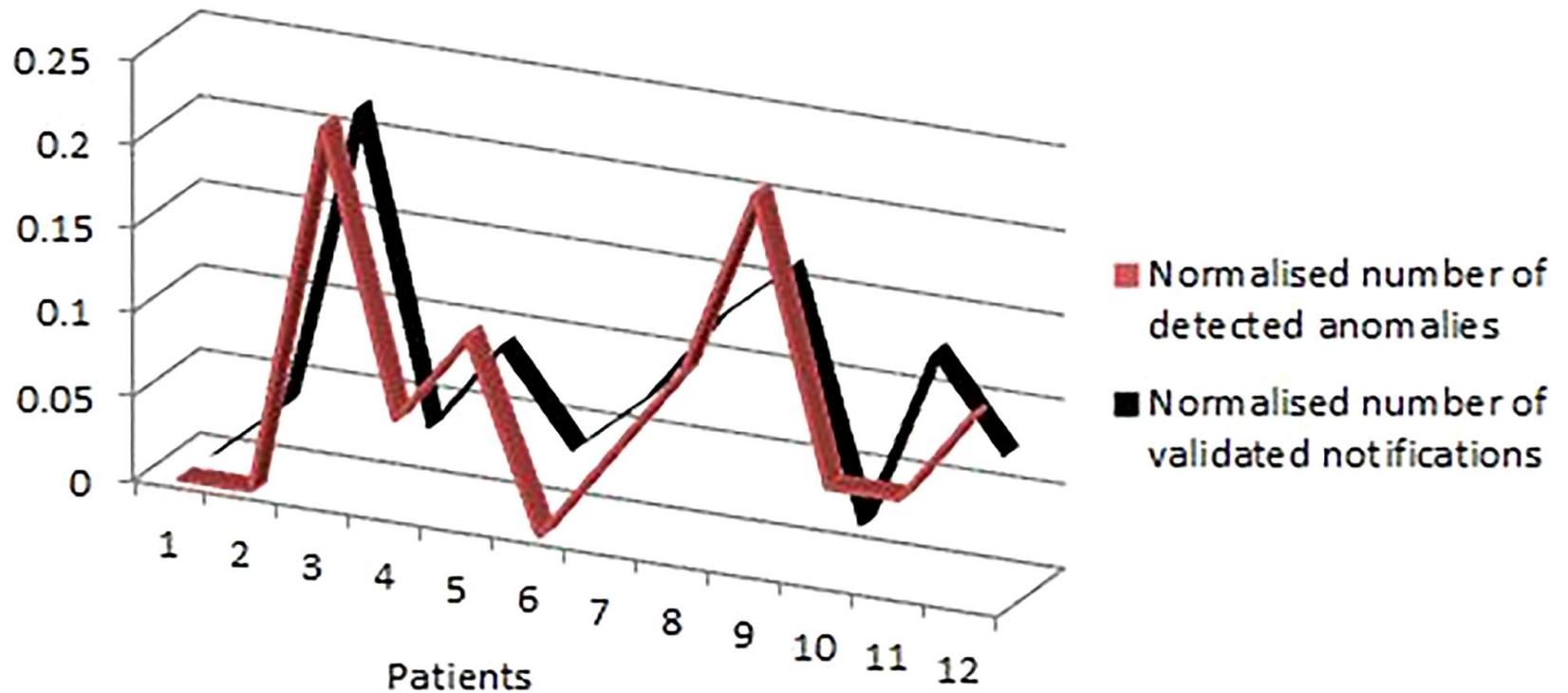
Aggregated daily pattern (2weeks)



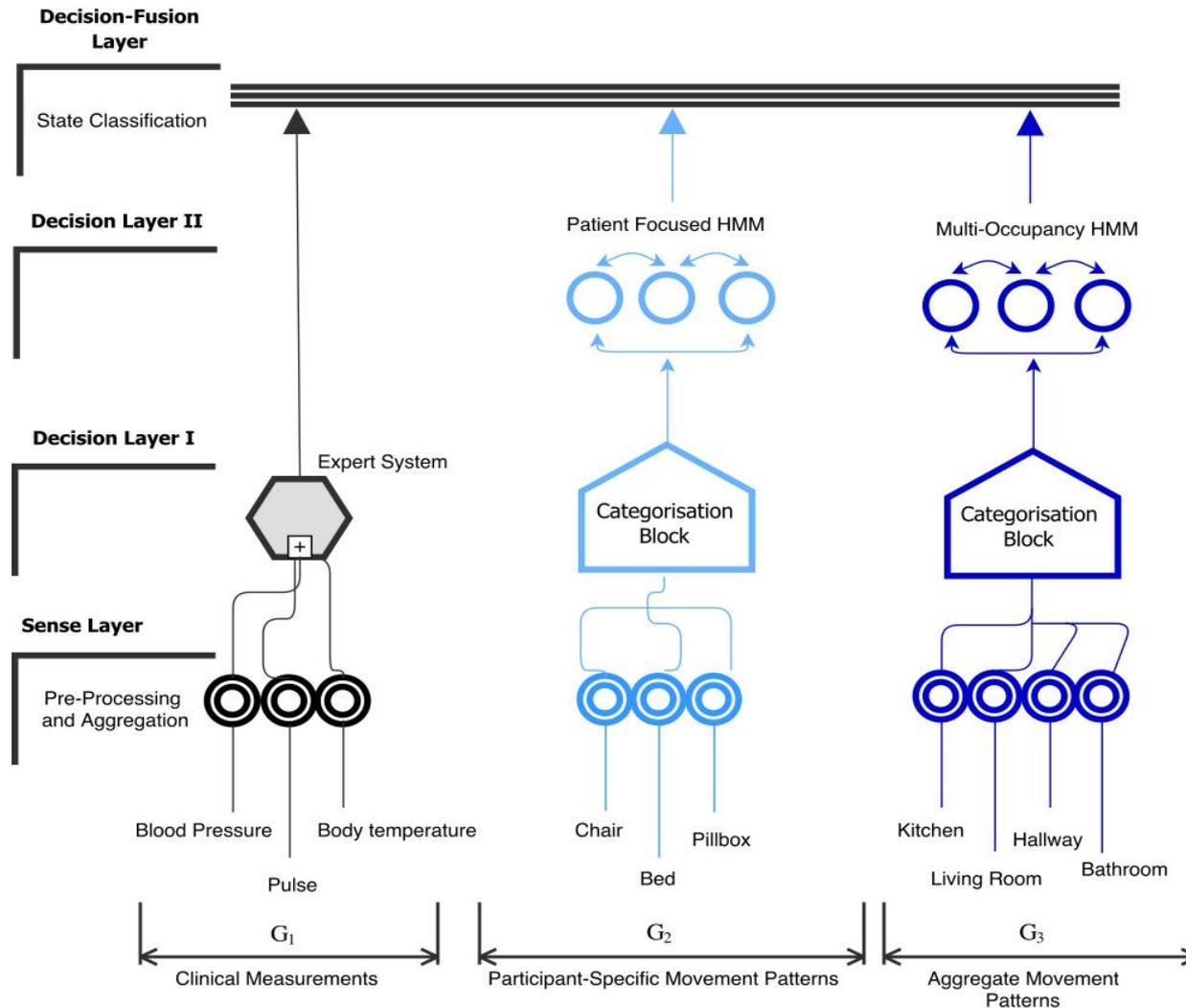
Machine learning for daily pattern analysis



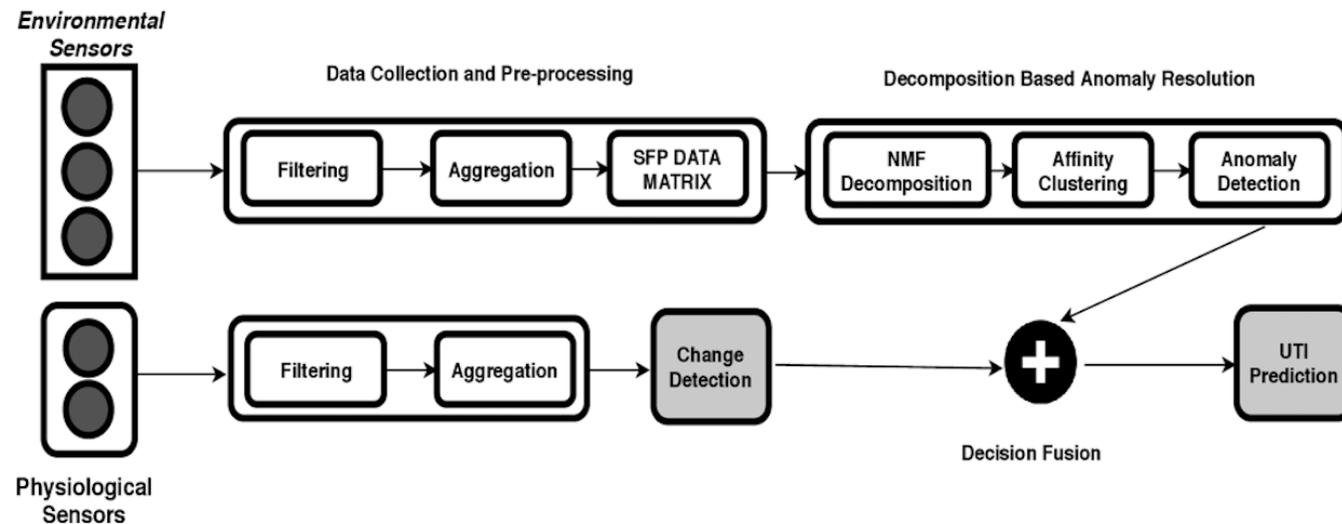
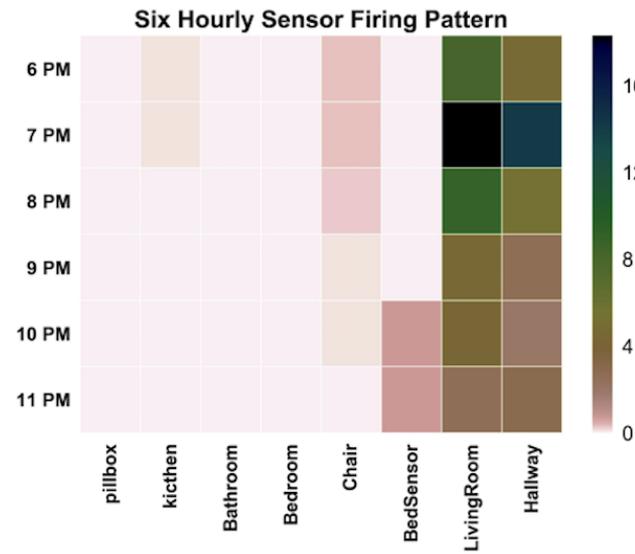
Daily activity and health related alerts



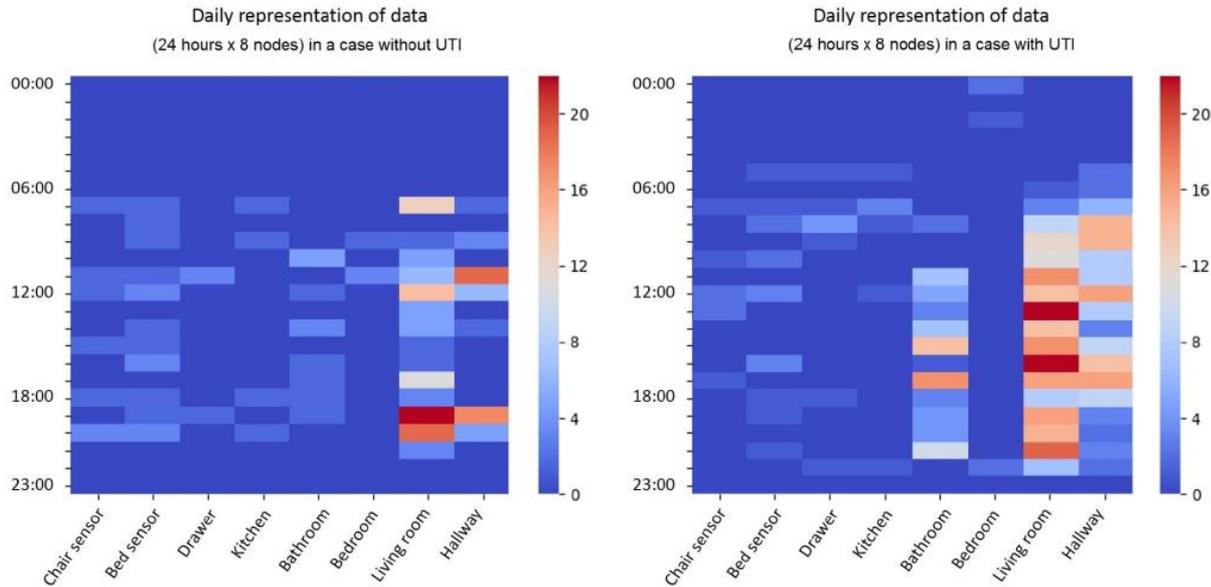
Aggression/Irritability/Agitation (AIA) Analysis



Urinary Tract Infection (UTI) risk analysis



Urinary Tract Infection (UTI) risk analysis



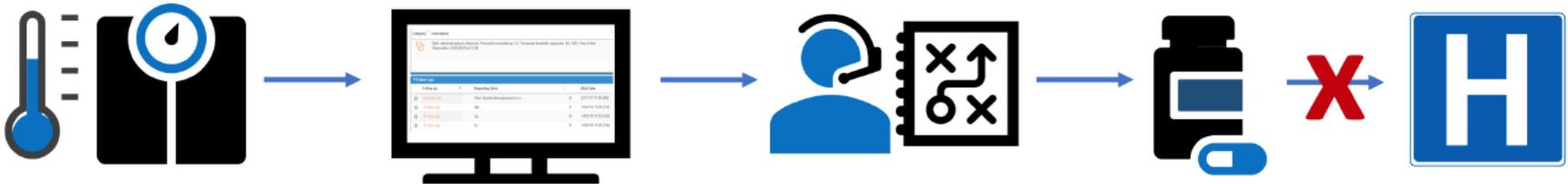
Biometric
Data

UTI detection

Home
Diagnosis

Early
Treatment

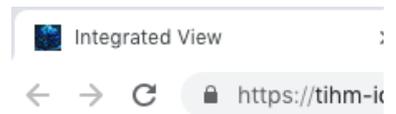
Reduced
Admissions



Has TIHM alerted you to any health problems?

Integrated View

CRC Living Lab Clinical: 17 High, 6 Low Environmental: 0 High, 0 Low Technical: 1 High, 0 Low Follow Ups: 11	5G Living Lab Clinical: 11 High, 4 Low Environmental: 1 High, 1 Low Technical: 0 High, 0 Low Follow Ups: 5	Andreas Markides Clinical: 5 High, 3 Low Environmental: 0 High, 0 Low Technical: 1 High, 0 Low Follow Ups: 1	David Brent Clinical: 5 High, 1 Low Environmental: 0 High, 0 Low Technical: 1 High, 0 Low Follow Ups: 1
ACU Monitoring Room Follow Ups: 0	Payam Barnaghi Follow Ups: 3	Mark Kenny Follow Ups: 3	Tom Acton Follow Ups: 0
Kieren Egan Follow Ups: 0	Benjamin Franklin Follow Ups: 0	Joseph Name Follow Ups: 0	



PATIENT DETAILS

Name: Mr Albert King
 Gender: Male
 TIHM ID: 1926...1987
 Study ID: 19261

01345 34121
 074 255 95 55

ME THRESHOLDS

Alerts Learned

Fall
 < 5 < 10 OK > 20 > 25

CLINICAL DASHBOARD

19261 Mr Albert King

ALERTS

- Body temperature alert from 5 days ago Alert needs following up Created: 18/08/18 02:00
- GPS alert from 7 days ago Alert can be closed Created: 15/08/18 02:00

PATIENT CALENDAR

Week 34

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug 24	Aug 25
	TIHM Q3 Review					
	Follow Up for Body...					

PATIENT NOTES

Search notes

Manage Notes New Note Show All

This note is always on top.
 by Mr Severin on 18 Aug 2018

EARLY WARNING SCORE

OBSERVATION SUMMARY

Last 14 days

- Blood Oxygen Saturation **97%** Newest * A Day Ago
- Heart Rate By Pulse Oximetry **78** beats/min Newest * A Day Ago
- Systolic **128** mmHg Newest * A Day Ago
- Diastolic **82** mmHg Newest * A Day Ago
- Body Weight **67.6** kg Newest * 2 Days Ago
- HRM **21.3** bpm Newest * 2 Days Ago

PATIENT LOCATION

Lat: 51.25409, Lng: -0.588537
 14 hours ago

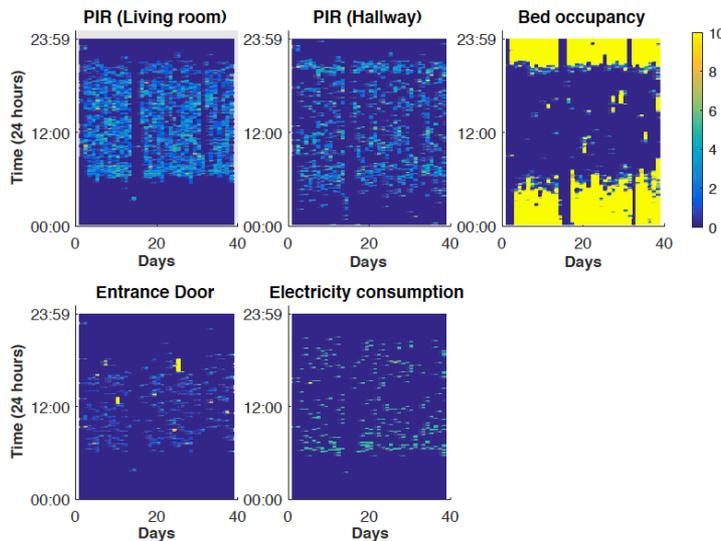
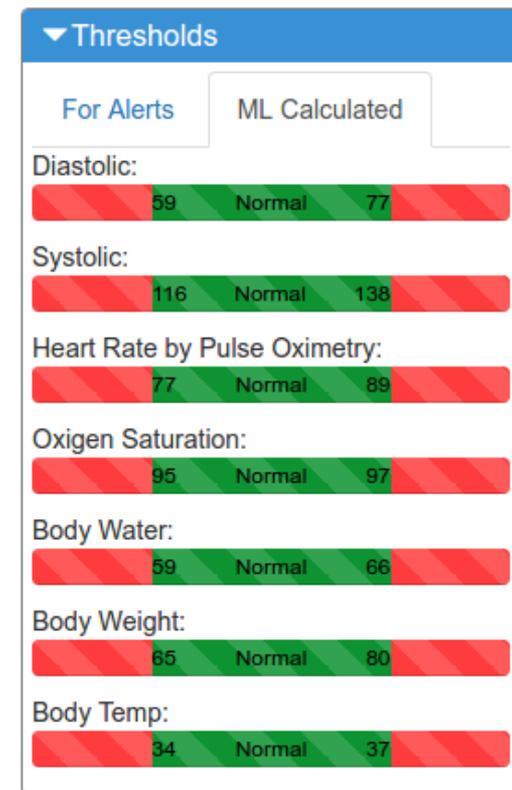
DATA STATUS

Machine learning: from data to actionable-information

▶ Daily Health Score

Thresholds Σ

01/02/18	6	0	3	3	0
31/01/18	7	2	3	1	1
30/01/18	3	1	2	0	0
29/01/18	1	1	0	0	0
28/01/18	3	3	0	0	0
27/01/18	1	1	0	0	0
26/01/18	2	1	1	0	0
25/01/18	2	1	1	0	0



AI and Machine learning for...

Detection

Urinary
Tract
Infections

Agitation/
Irritation

Hyper
tension

Changes in
Daily
Routine

Prevention

Early
Warning
Score

Falls/
Fractures

Serious
Conditions

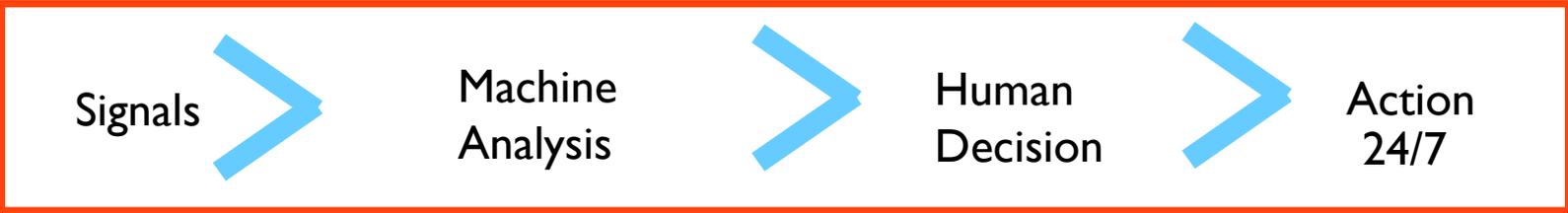
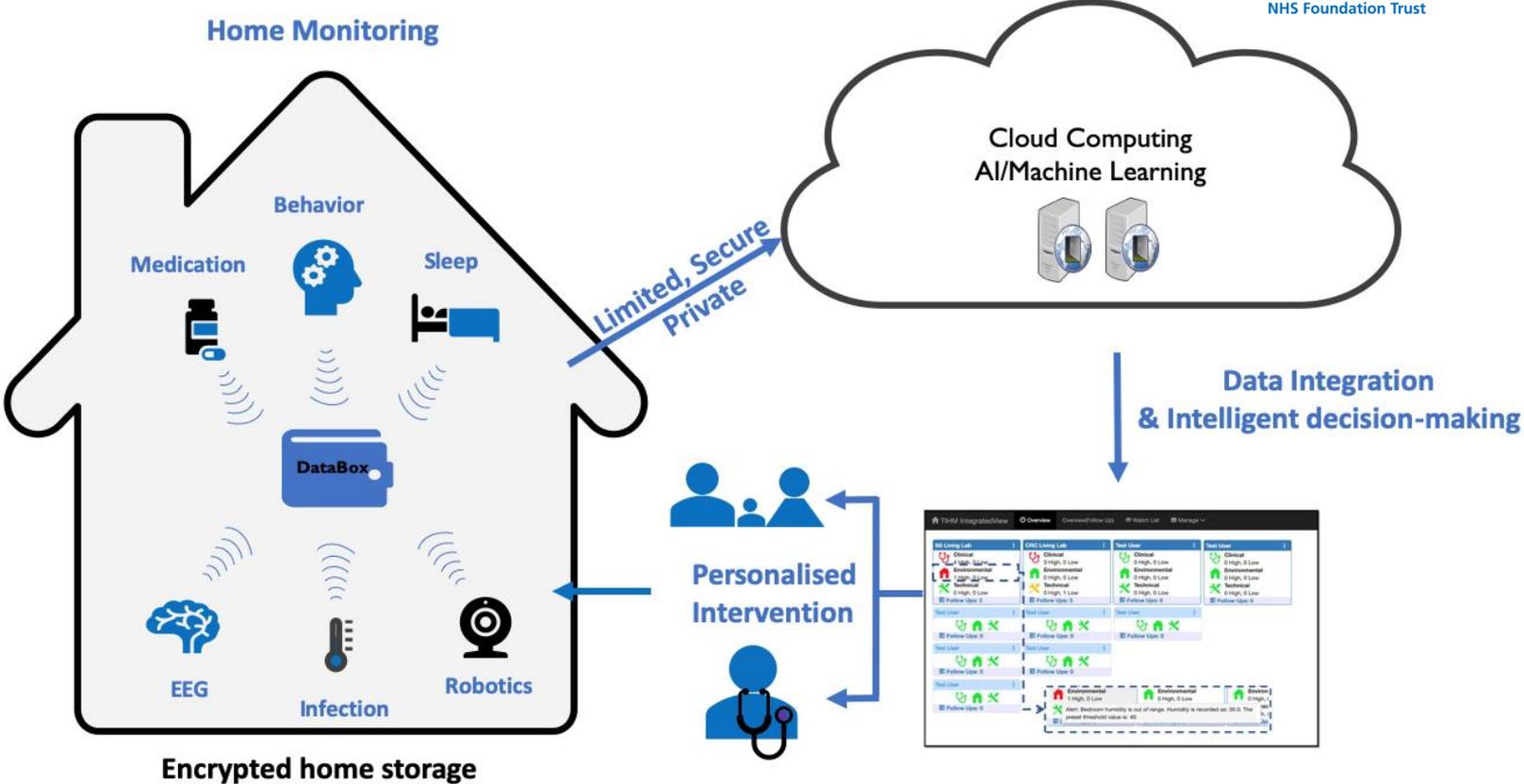
Respiratory
Problems

Phil and June – Trusted Users

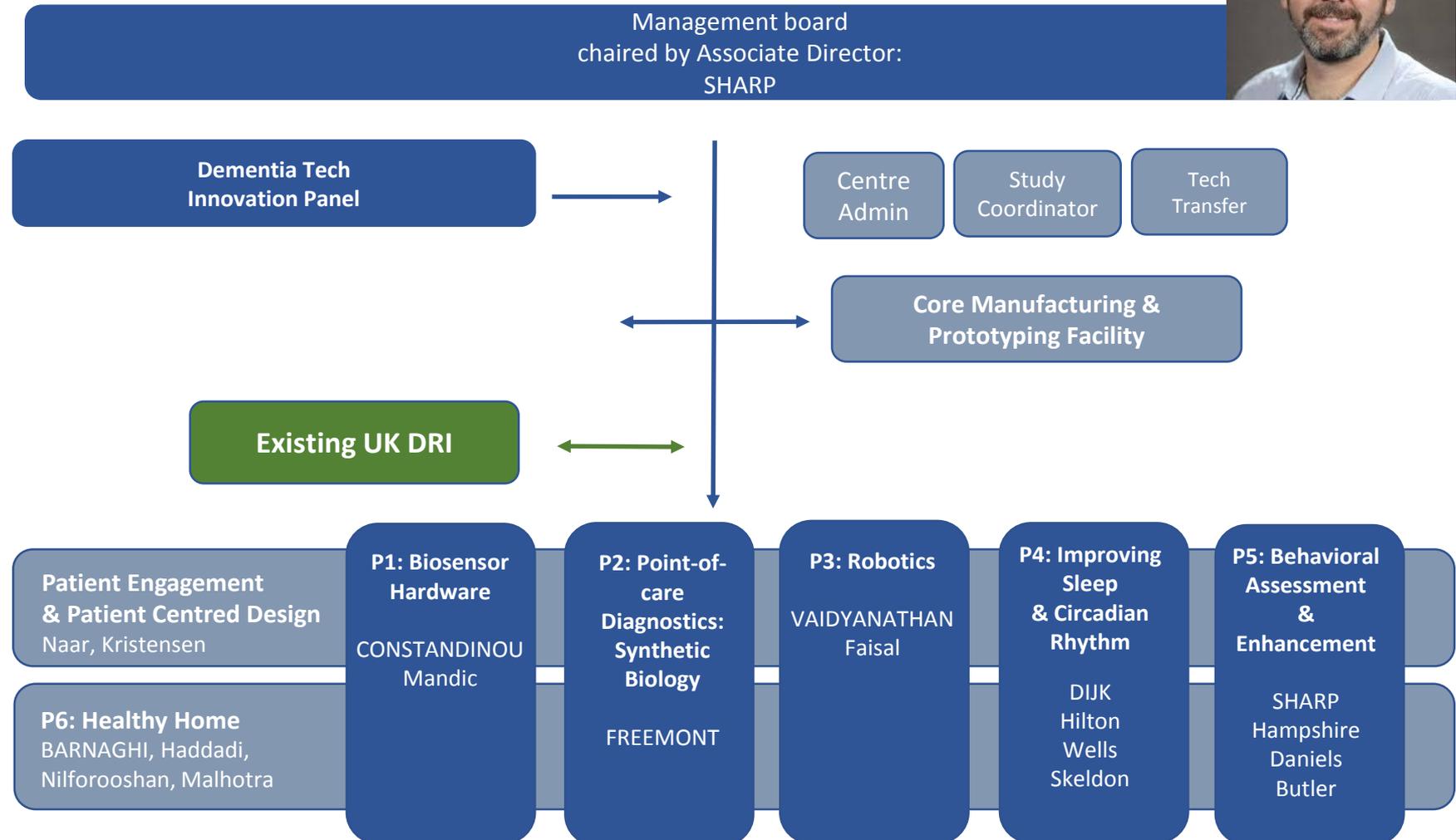


TIHM for dementia

- Improved care and support for people with dementia and their carers;
- Pioneering use of artificial intelligence to support early intervention – avoiding unplanned hospital admissions and reducing visits to GPs;
- Supporting the clinicians by providing continuous data and actionable information;
- Developing solutions that are also applicable to other long-term conditions.



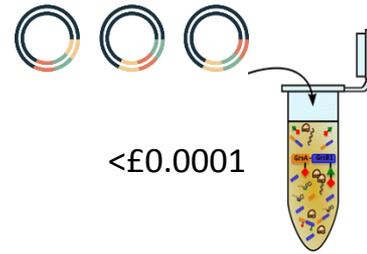
The DRI Care Research and Technology Centre



The DRI Research



Voice control & Conversation



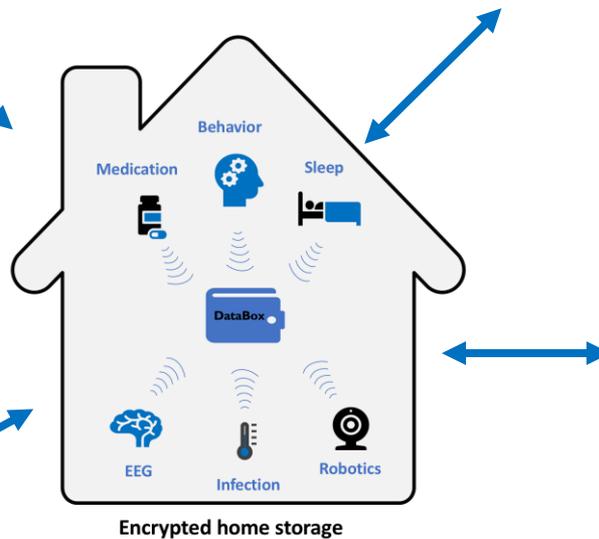
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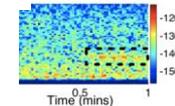
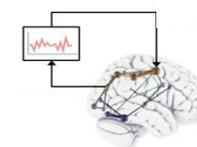
Synthetic biology



Sleep, Environmental control

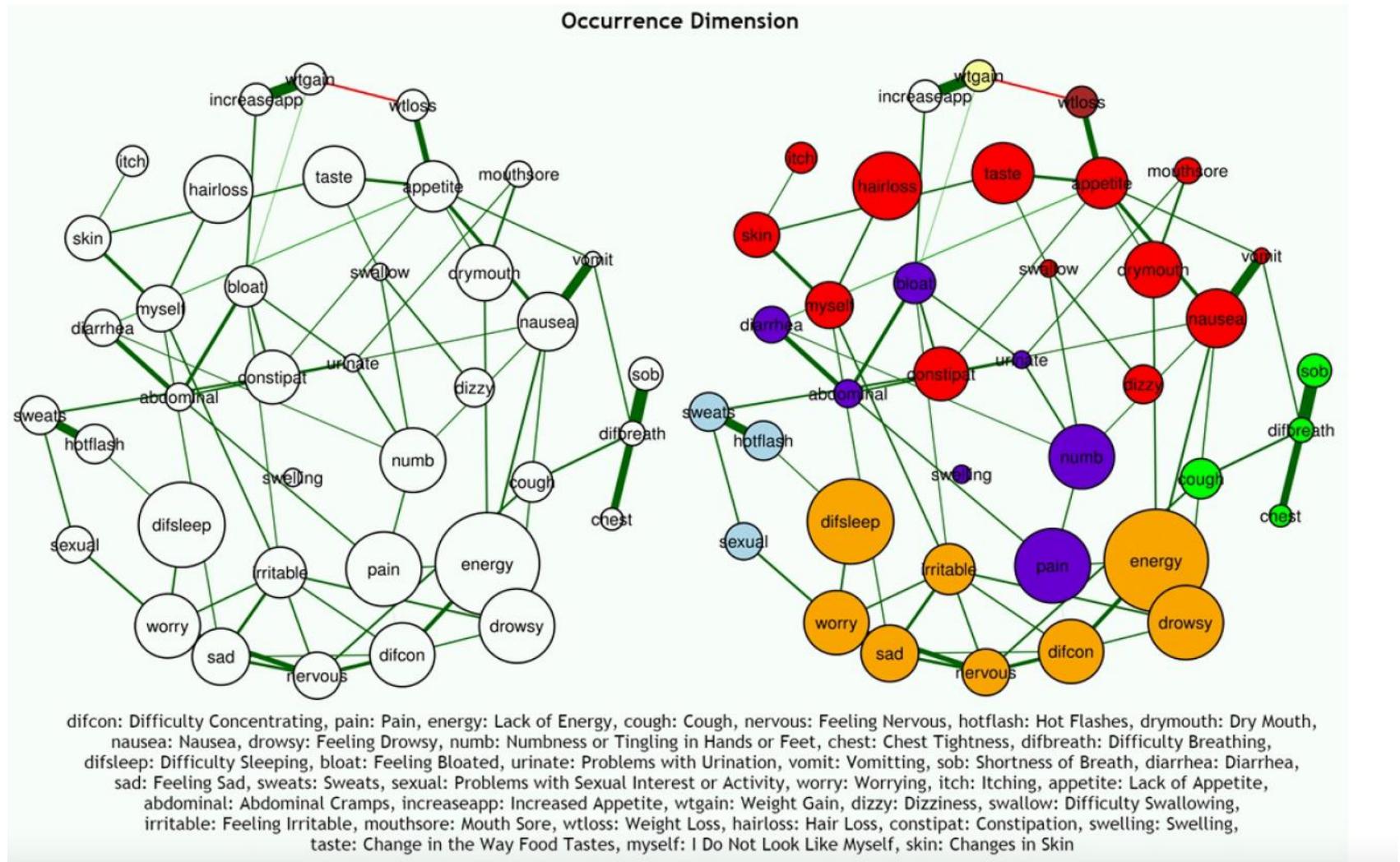


Social Robotics

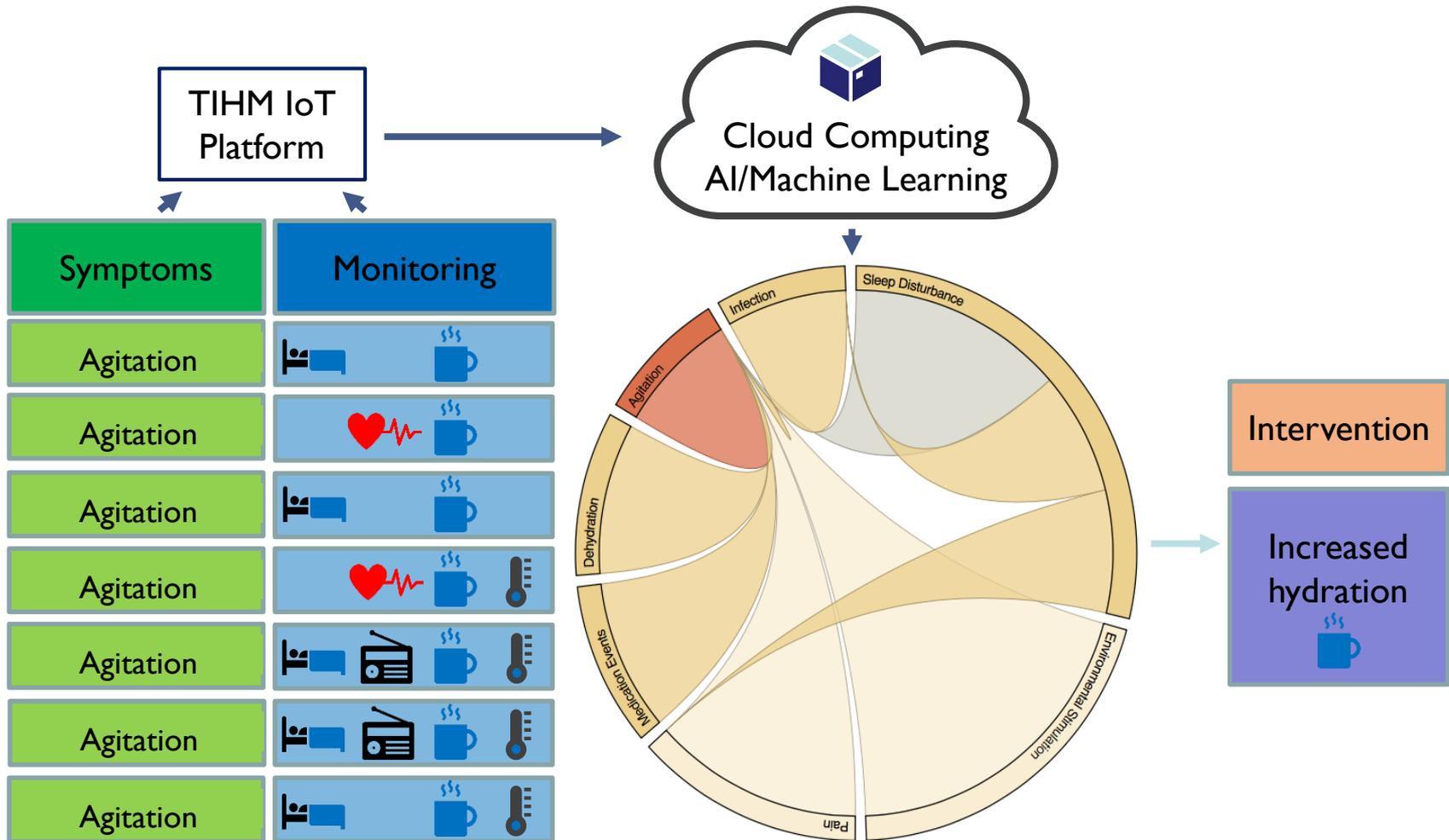


Biosensor hardware and Monitoring technologies

Symptom network modelling

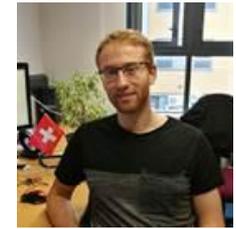


Causal models





Acknowledgments



Department
of Health



Surrey and Borders Partnership
NHS Foundation Trust



Thank you!

