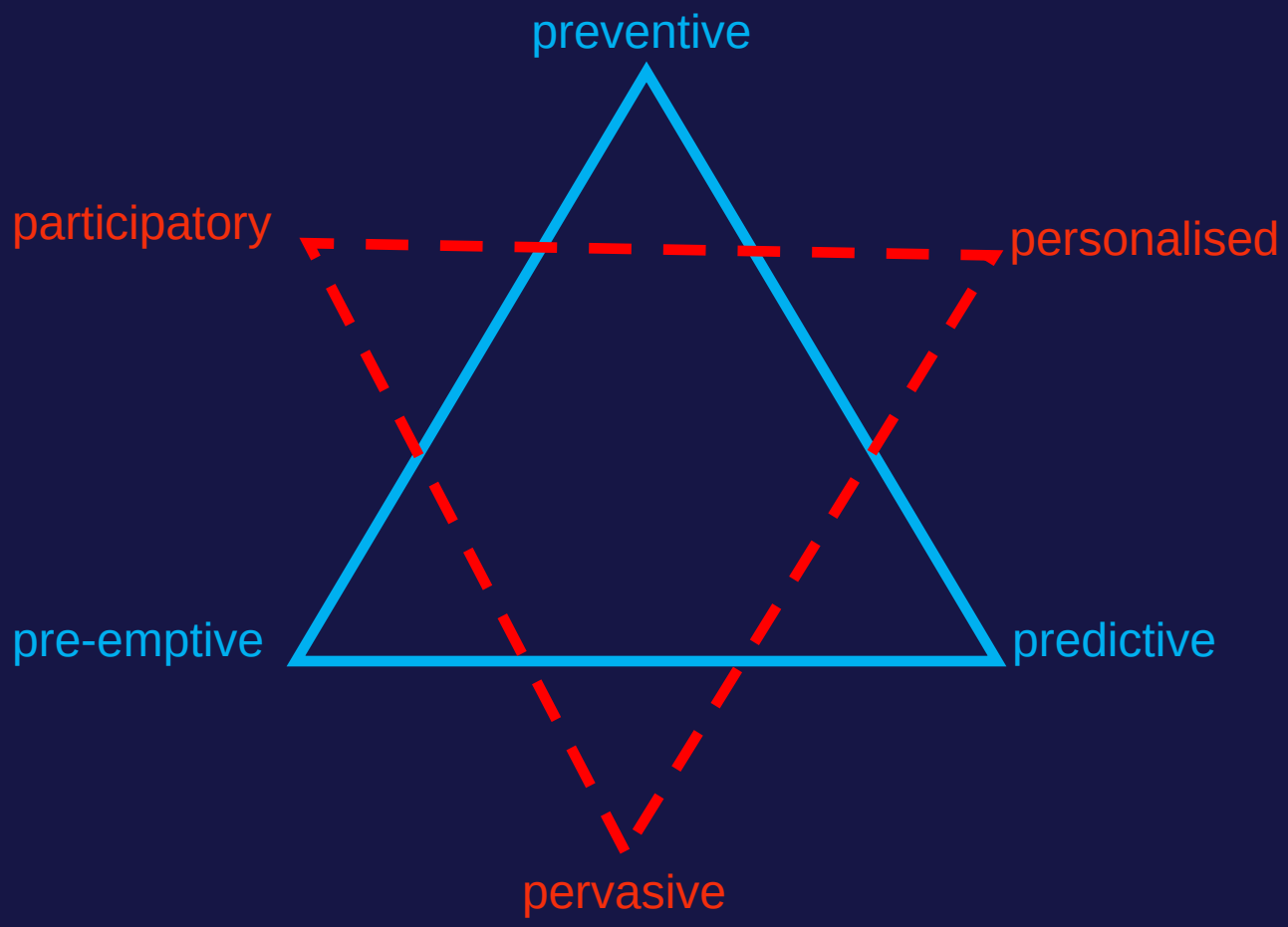

TRIL
Technology Research
for Independent Living
UCD
DUBLIN
TRINITY
COLLEGE
DUBLIN
IDA
IRELAND

Convergence of Forces Driving Change in Today's Healthcare System

new models of care required

6-P's Paradigm....

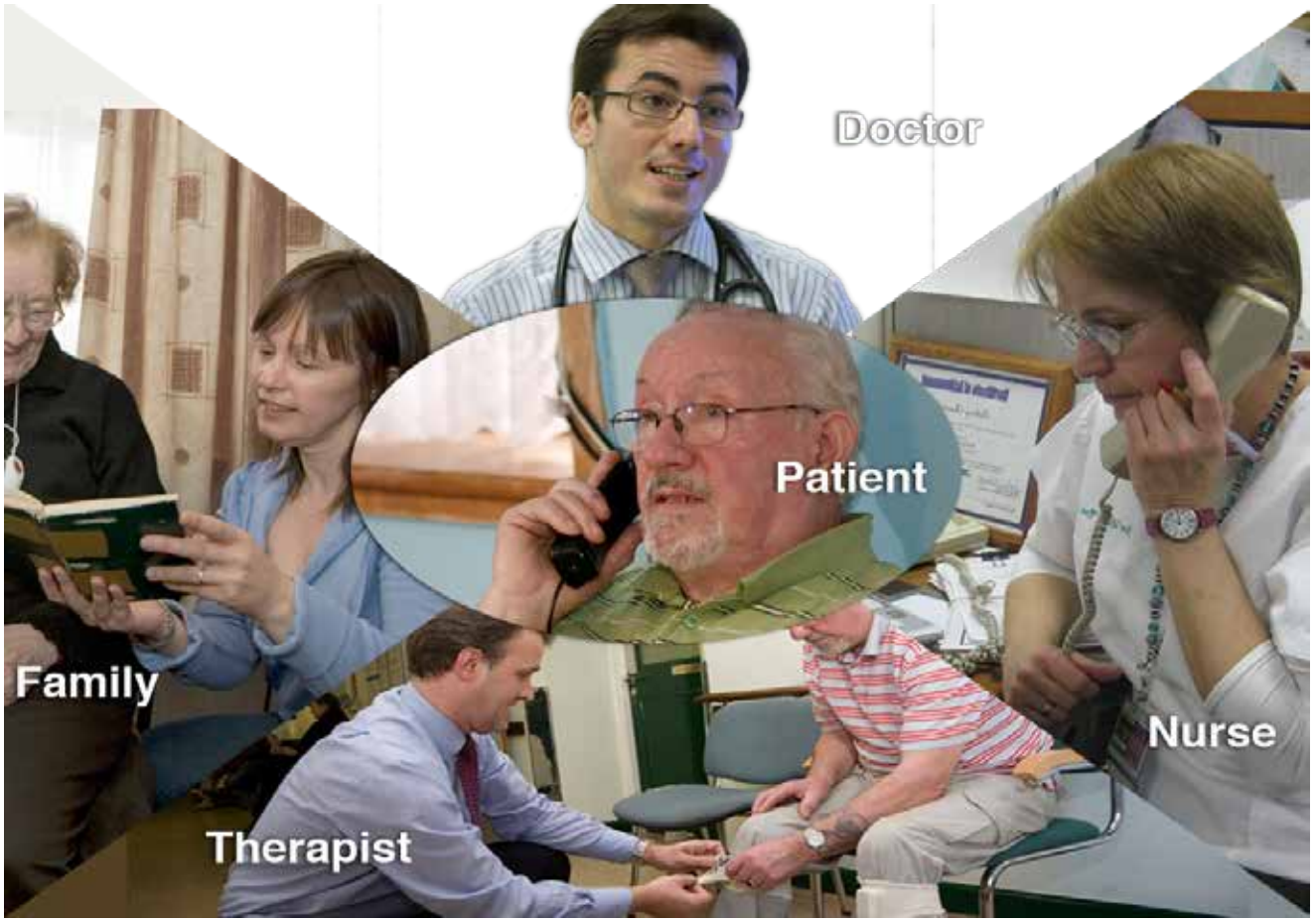


how healthcare decisions should be made

what kind of healthcare decisions should be made

Poon & Zhang (2008)

User Centred Delivery of Care



Technology Research
for Independent Living

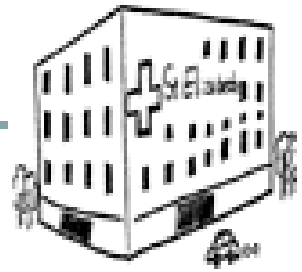
Our Goal

Staying at Home

Quality of Life

Primary & Residential Care

Acute Care



COST [$/Day]

Technology Research
for Independent Living

Our Challenge

Technology Research
for Independent Living

Global Opportunity

- Clever technology can help solve two big problems in health care:
  - overspending in the rich world
  - limited access in the poor world.
- Biggest winner is the empowered patient that will result

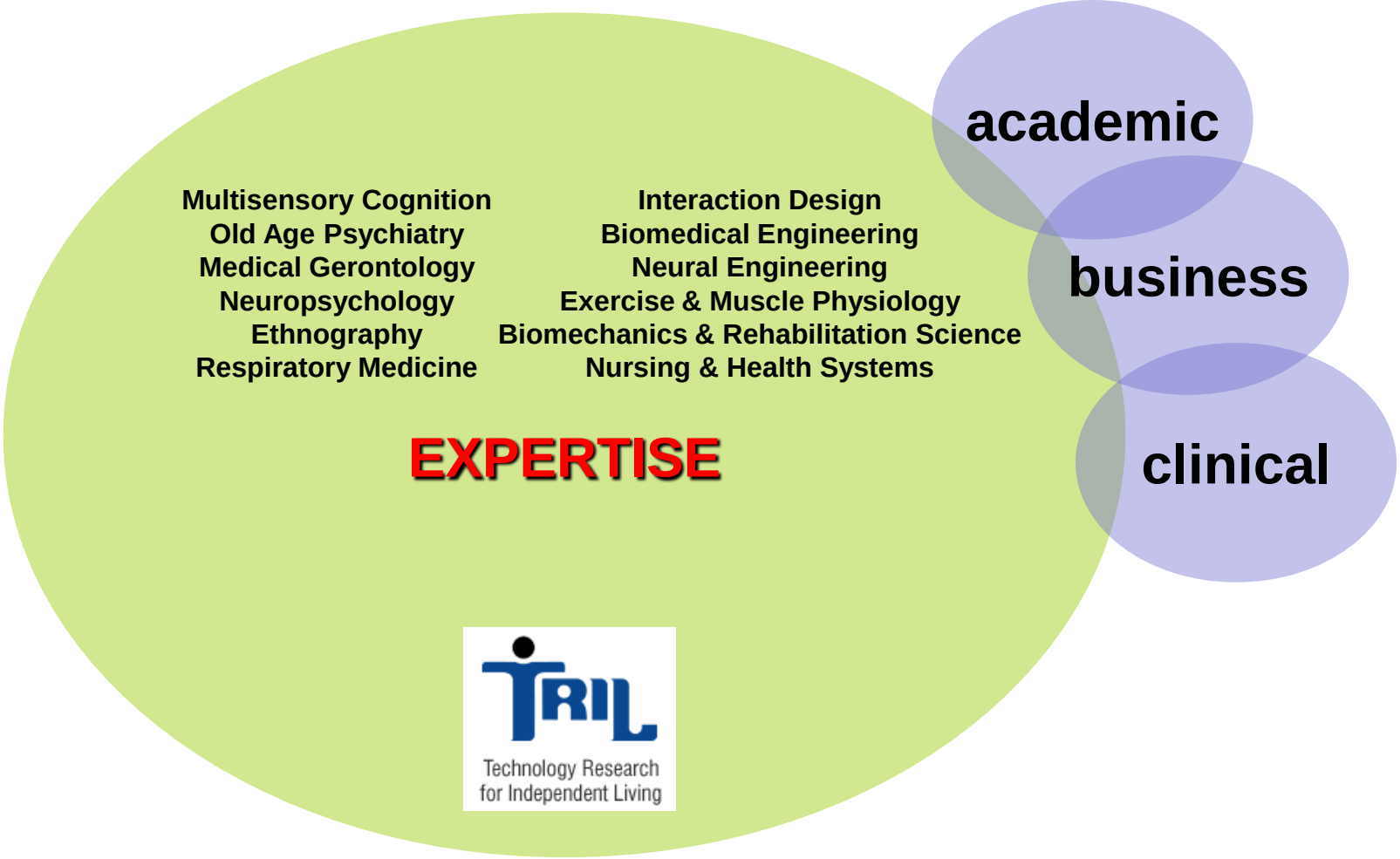
Economist Special Report

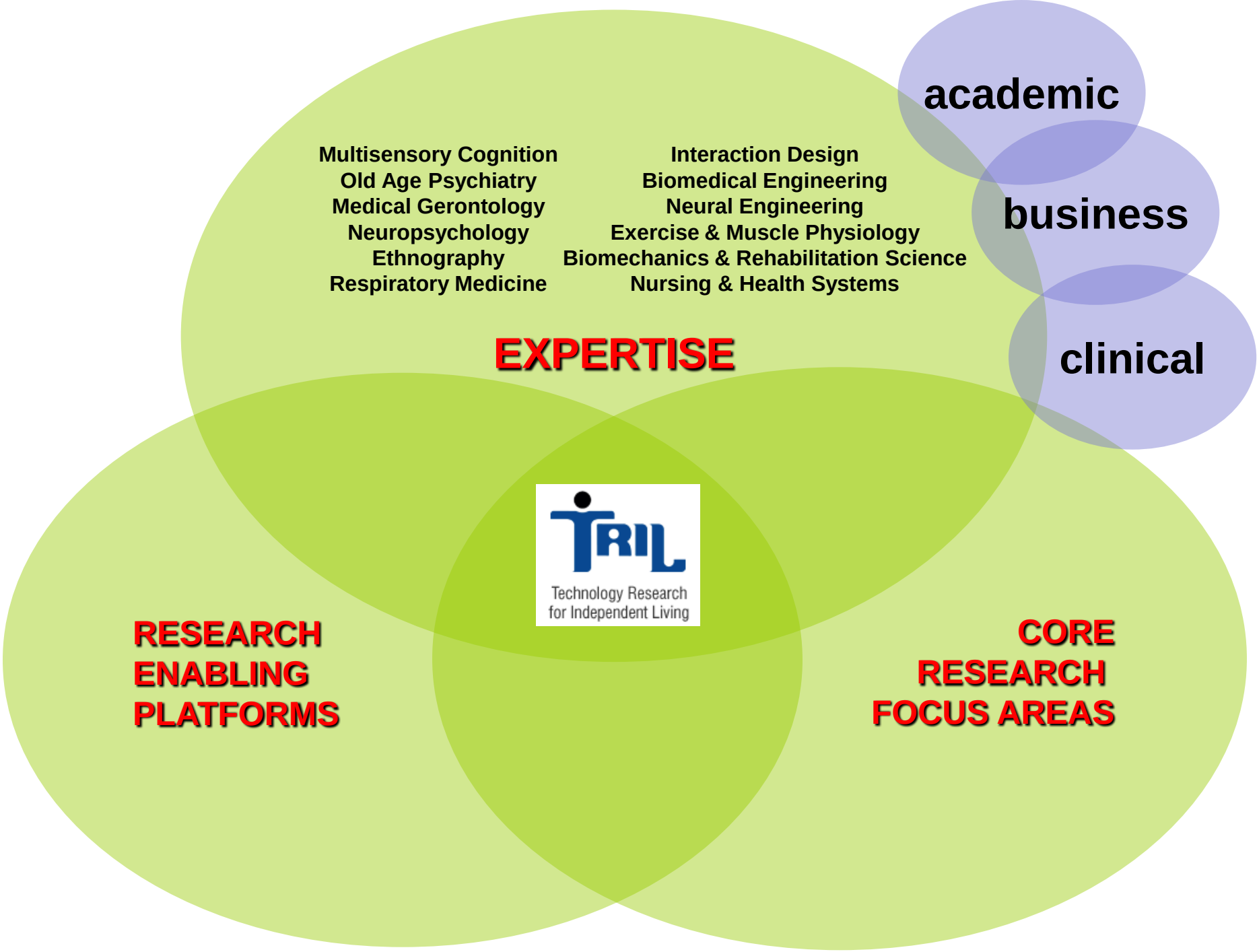
Technology Research for Independent Living

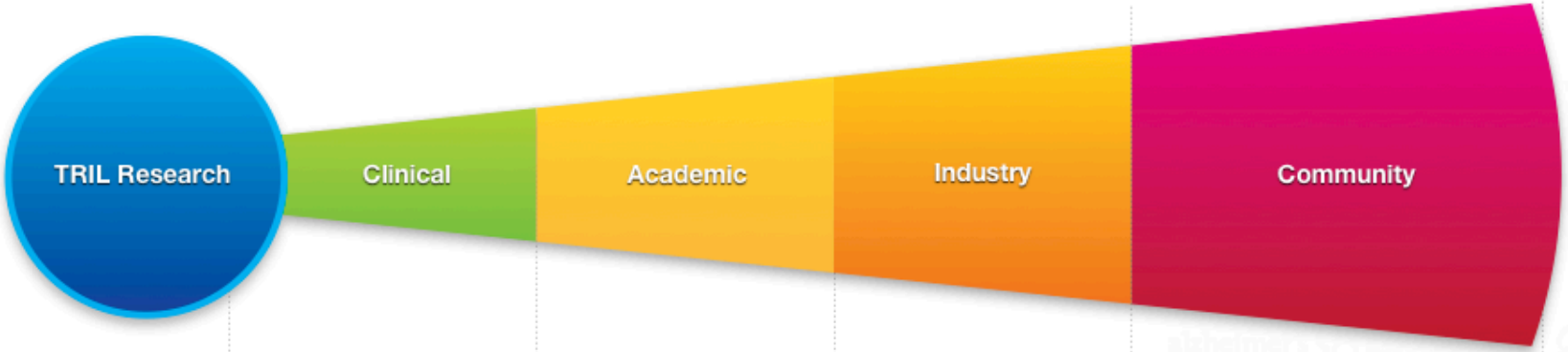
How can we make this happen?

- Multiple stakeholder input needed to deliver:
  - Comprehensive understanding of the needs of and issues facing the ageing population
  - Enhanced insight into complex interactions between biopsychosocial variables in determination of capacity for independence
  - Identify critical variables that are appropriate for remote monitoring of healthcare status
  - Identify potential role of technological solutions and design and evaluate new technology enabled care models for promotion of independent living and delivery of healthcare in the home
  - Business case for new models of care that result

Technology Research for Independent Living

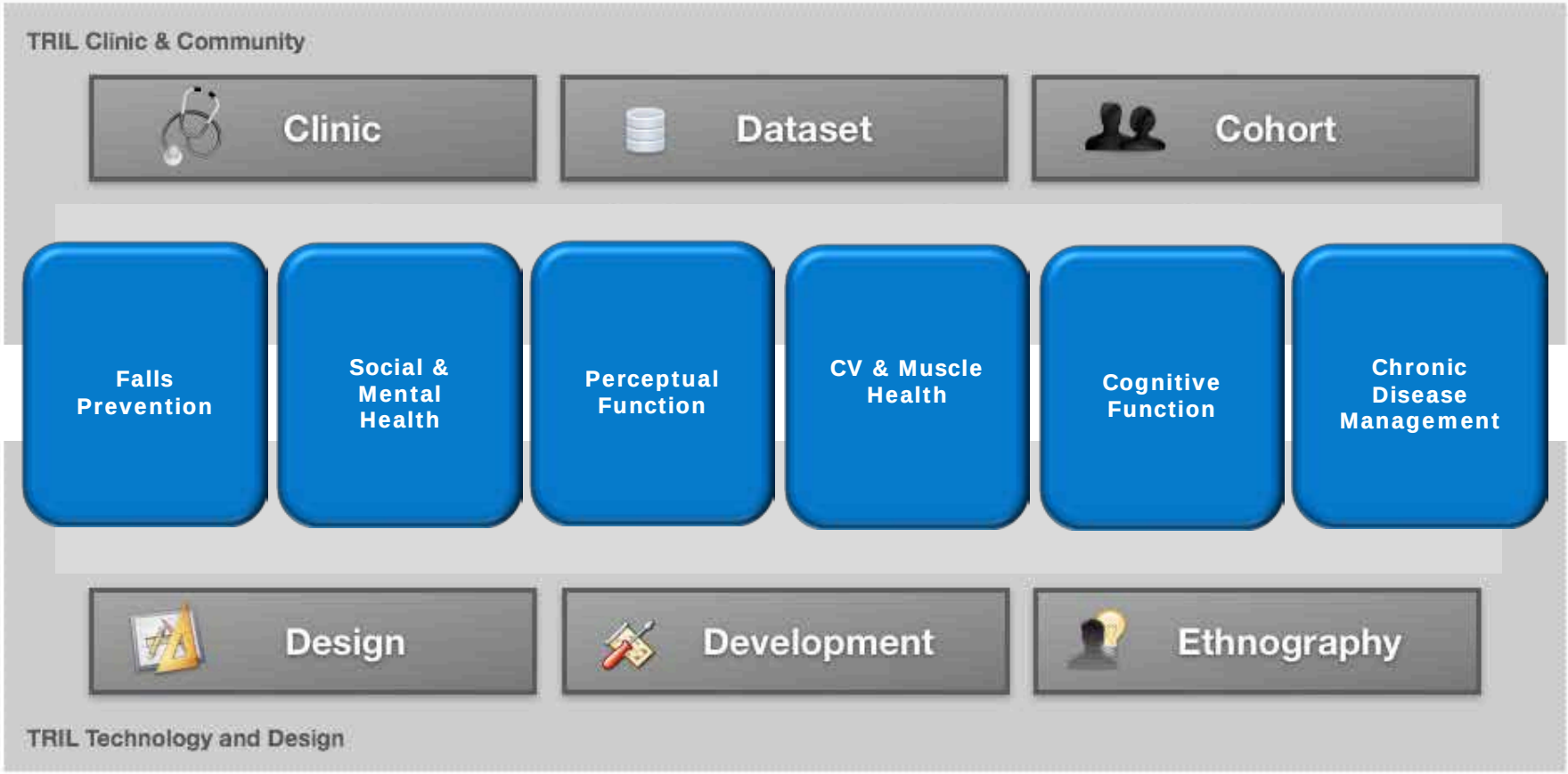

academic
business
clinical
Multisensory Cognition
Old Age Psychiatry
Medical Gerontology
Neuropsychology
Ethnography
Respiratory Medicine
Interaction Design
Biomedical Engineering
Neural Engineering
Exercise & Muscle Physiology
Biomechanics & Rehabilitation Science
Nursing & Health Systems
EXPERTISE
TRIL
Technology Research
for Independent Living


academic
business
clinical
Multisensory Cognition
Old Age Psychiatry
Medical Gerontology
Neuropsychology
Ethnography
Respiratory Medicine
Interaction Design
Biomedical Engineering
Neural Engineering
Exercise & Muscle Physiology
Biomechanics & Rehabilitation Science
Nursing & Health Systems
EXPERTISE
TRIL
Technology Research
for Independent Living
RESEARCH
ENABLING
PLATFORMS
CORE
RESEARCH
FOCUS AREAS



TRIL Technology Research for Independent Living	St. Vincent's University Hospital	UCD DUBLIN tilda CLARITY bdi CASALA	intel GE careinnovations an Intel•GE company Pfizer Vitalograph shimmer BiancaMed	alzheimer's association parkinsons.ie IAHSA Ageing Well Network cast Third Age FOUNDATION Trinity Consortium on AGEING CARDI THE ALZHEIMER SOCIETY of IRELAND ORCATECH Caring for Carers IRELAND	Partners
	• In-depth Clinical Assessments • Cohort Recruitment & Management • Data Management	• Scientific research • Data Mining, Analysis & Storage • Understanding the Ageing Process	• Rapid Prototyping • Ethnography & Design • Tech Evaluation • Clinical Trials	• User Forums • Design Workshops • Technology Evaluation • Policy • Home Technology Deployment	Activities
Established in 2007, TRIL is an active collaboration between researchers in academic, clinical and industry settings	A functioning clinic established in St. James Hospital. Partnership with Clinical Research Team at St. Vincent's University Hospital	Established alliance with 5 leading research centres within Ireland and Ireland's leading research Universities.	Over 16 technologies developed and deployed to the community	Forums, workshops and evaluations conducted with over 250 older adults. Established network of community support with over 20 agencies, groups & organisations	Summary

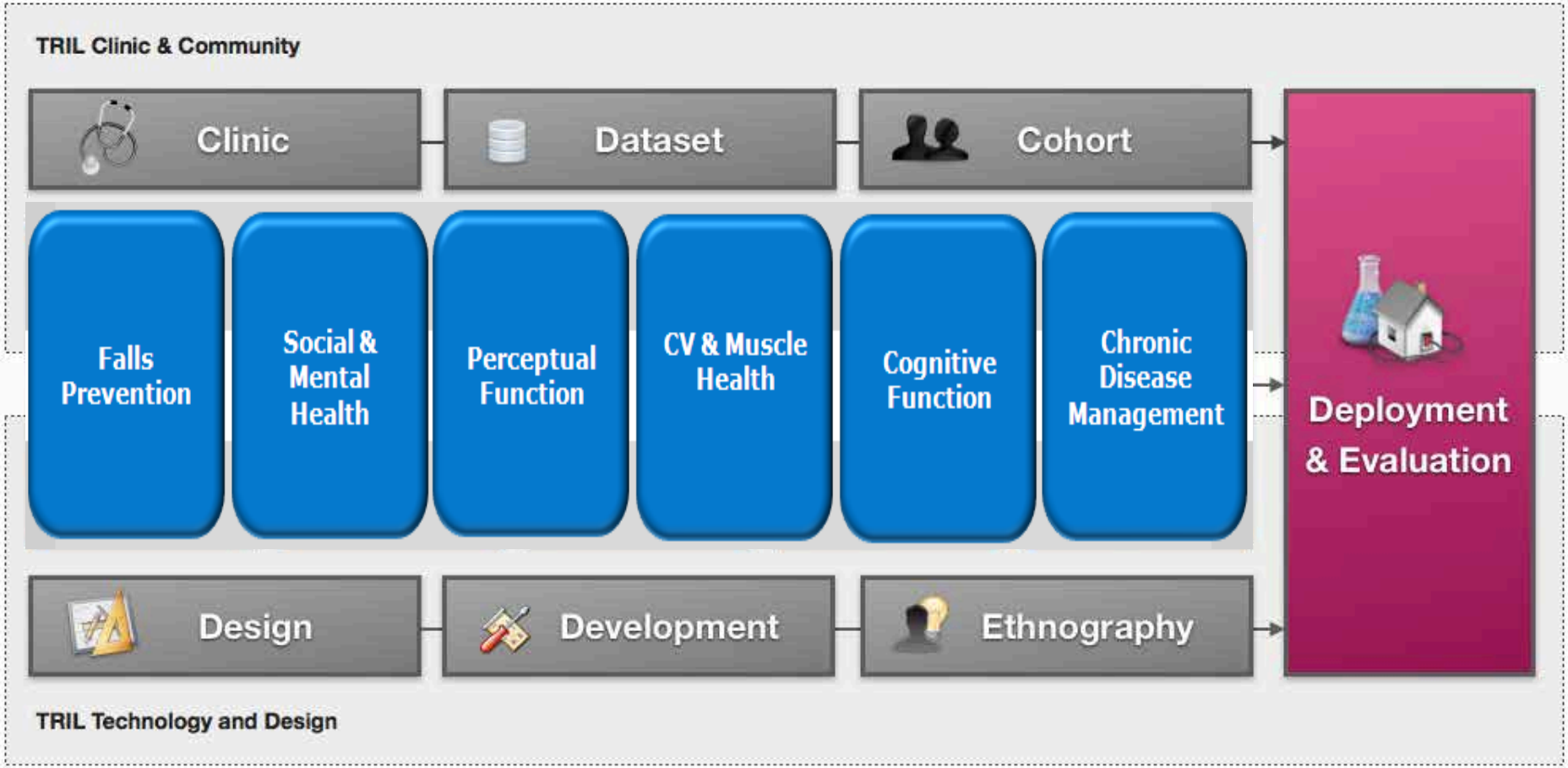
TRIL Technology Research for Independent Living



DISCOVERY | DESIGN | IMPLEMENTATION | EVALUATION

Basic Research | Translational Research | Applied Research

TRIL Technology Research for Independent Living



DISCOVERY | DESIGN | IMPLEMENTATION | EVALUATION

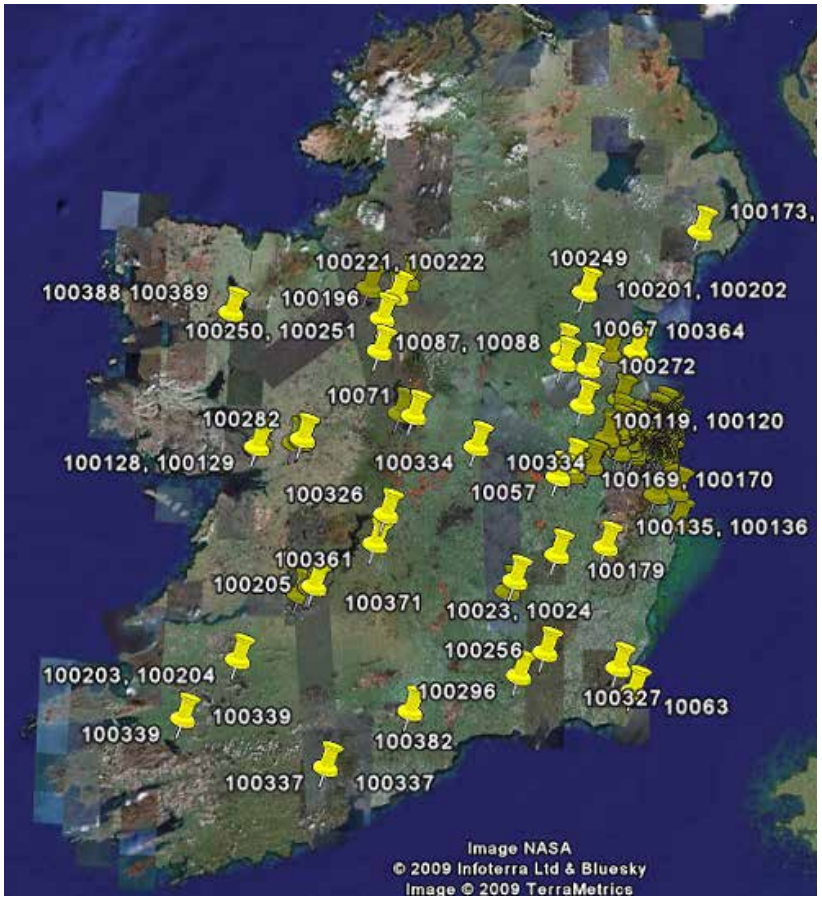
Basic Research | Translational Research | Applied Research

TRIL Community







- **TRIL cohort assists with ageing research, and technology design and evaluation.**
- **Rich biopsychosocial dataset collected from over 600 volunteer participants**
- **Longitudinal follow up on 400 participants to date**

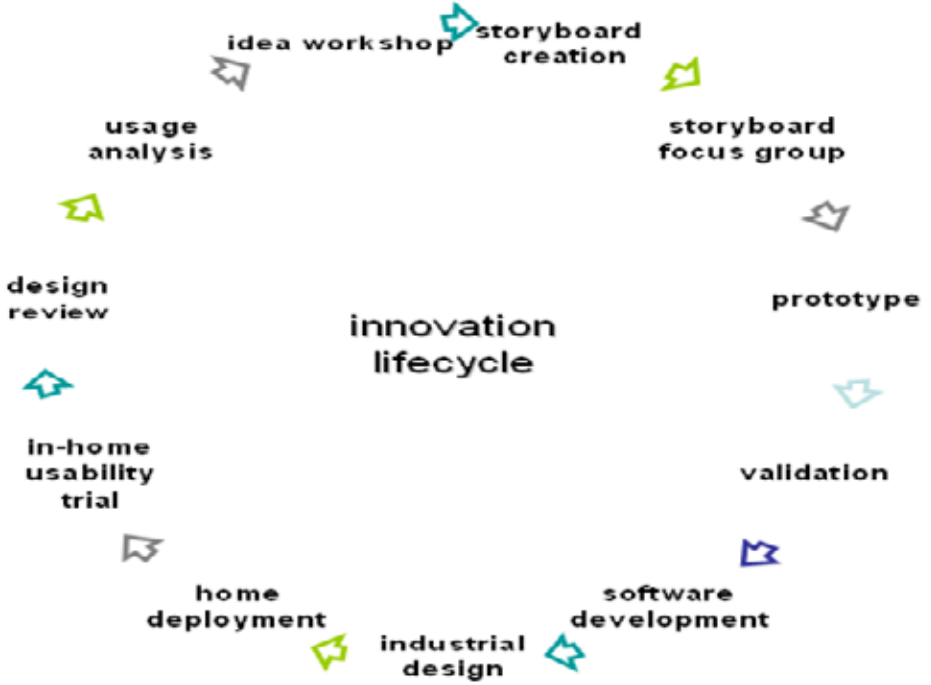
TRIL Technology & Design

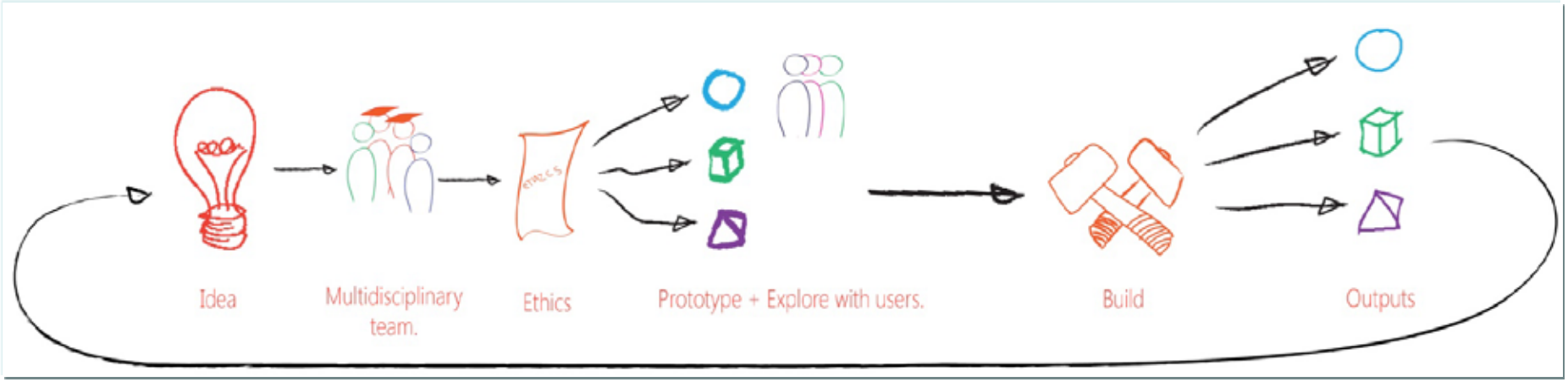
SOFTWARE ENGINEERING
BIOMEDICAL ENGINEERING
INTERACTION AND INDUSTRIAL DESIGN

ETHNOGRAPHY
INFRASTRUCTURE AND DATABASE MANAGEMENT
HUMAN COMPUTER INTERACTION

FIRMWARE / HARDWARE
DESIGN ENGINEERING

User-Centred Design

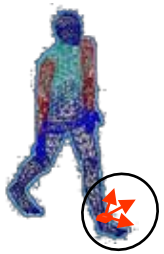
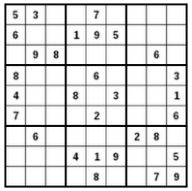




rapid prototyping with scalable & reusable platform

Kinematic Sensing	Physiological Sensing	Ambient Sensing
Accelerometer	ECG	PIR Motion
Gyroscope	EMG	Temperature
Magnetometer	GSR	Vibration
		Light
		UVB

Sensor Type ➡

GSR	PIR	Accelerometer /Gyro/Mag	EEG	ECG
			 	

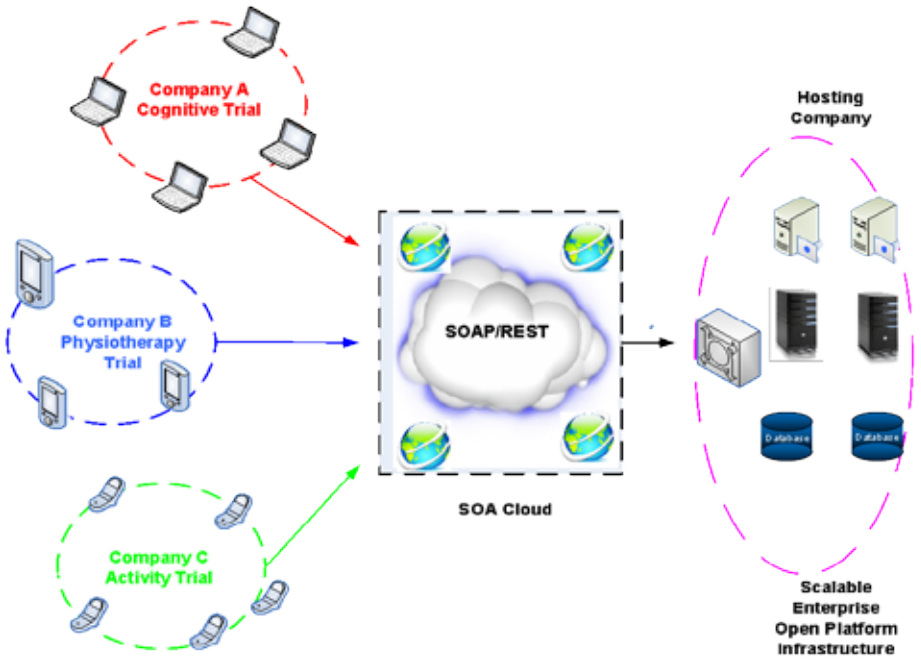
Project ➡

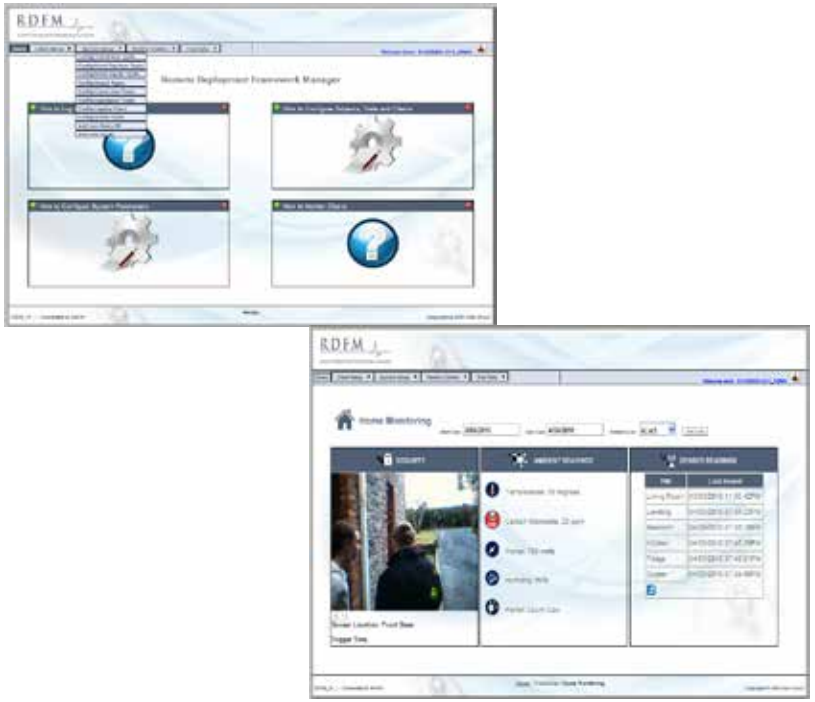
Engineering Alertness	MuSensor	Gait Analysis 30M Walk	Skuduko	Gait Analysis

shimmer DISCOVERY IN MOTION

BioMOBIUS™

Remote Deployment Framework Manager





Secure data communication, storage and access infrastructure in place to facilitate deployment programme

- Single console to manage multiple trials simultaneously
- Secure data capture, transport and storage model
- Remote access allows:
  - Device Management
  - Real-time trial data

Home/Community Technology Evaluations

Taking research from the Lab to the Home

- TRIL specialises in deployment and evaluation of technologies in an uncontrolled real world environment
- Purpose
  - *Monitoring*
  - *Evaluation & Assessment*
  - *Prevention & Intervention*
  - *Communication*
  - *Caregiver Support*
- Focus on
  - *Usability*
  - *Clinical Efficacy*
  - *Robustness*

To Date.....

- **27 Design Workshops**
- **16 Home Trials**
- **563 Homes visited**
- **.5 TB Data Collected**

Technology Research for Independent Living

Evaluation of Potential for Technology Enabled COPD Management in Home

TRIL Centre
&
St Vincent's University Hospital
Clinical Research Centre

careinnovations™ an Intel • GE company BiancaMed shimmer Vitalograph® Your respiratory partner

COPD

- Respiratory diseases, largely represented by COPD, are the third most common cause of acute hospital admission.

- **Cost of COPD:**
  - *The average cost of COPD per hospital in-patient case is 39% higher than the average case cost.*
  - *2nd most common cause of A&E presentation*
  - *Average Length Of Stay in Ireland (LOS): 7 days*
  - *30% chance of early readmission post discharge*
  - *Average LOS post readmission: 11 days*
  - *Cost in USA in 2010 estimated at nearly $50billion(1)*

- **Increasing prevalence:**
  - The health burden of COPD will continue to increase in line with population ageing.

    COPD increases with age; 50% of those over 70 have the disease

Technology Research for Independent Living

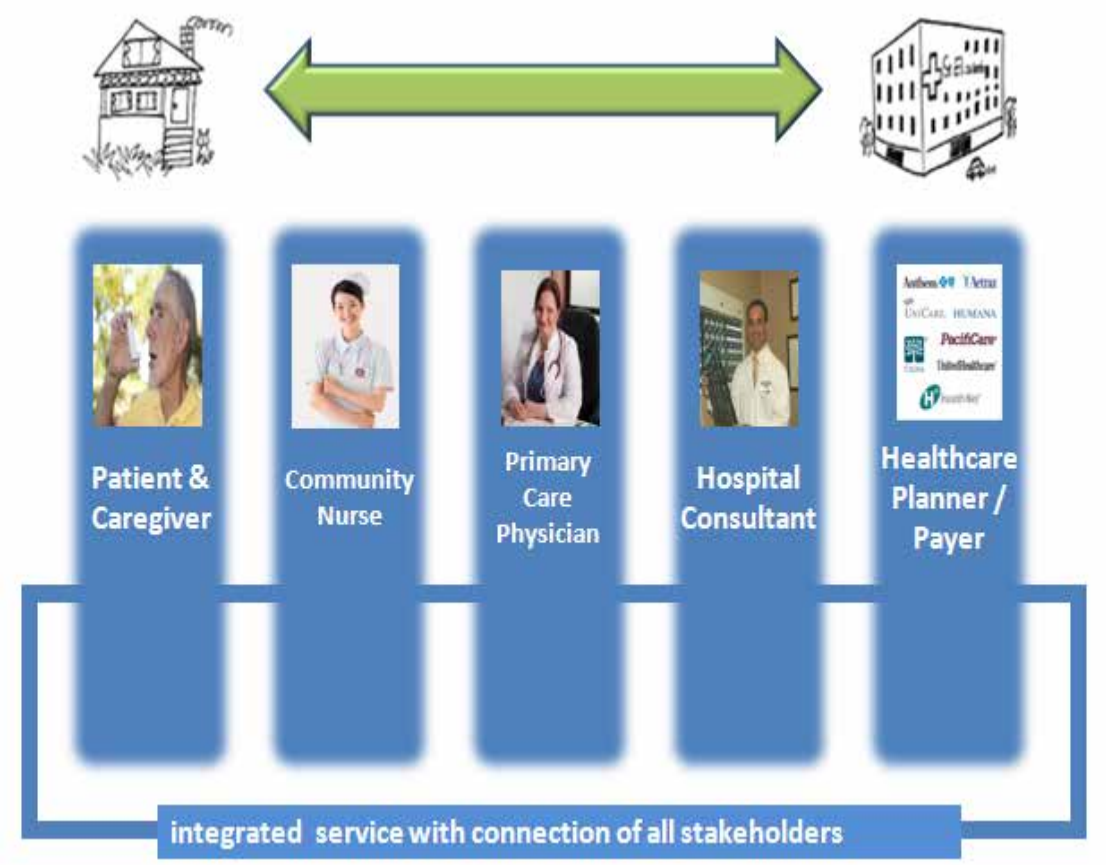
(1) National Heart Lung Morbidity and Mortality: 2009 Chartbook on Cardiovascular, Lung and Blood Diseases

Progression of COPD

- Repeated exacerbations requiring expensive hospital admission – usually through ER
- Gradual decline in functional independence and reliance on healthcare services
- High incidence of depression and poor quality of life

Reducing the impact of COPD

- Need to find home based solutions for managing COPD
- Home based care can deliver…
  - Reduced economic cost due to reduced admission rate
  - Enhanced quality of life for patient due to maintaining ability to live at home



Significant opportunity to use technology solutions to deliver efficient care model if all stakeholders can be connected

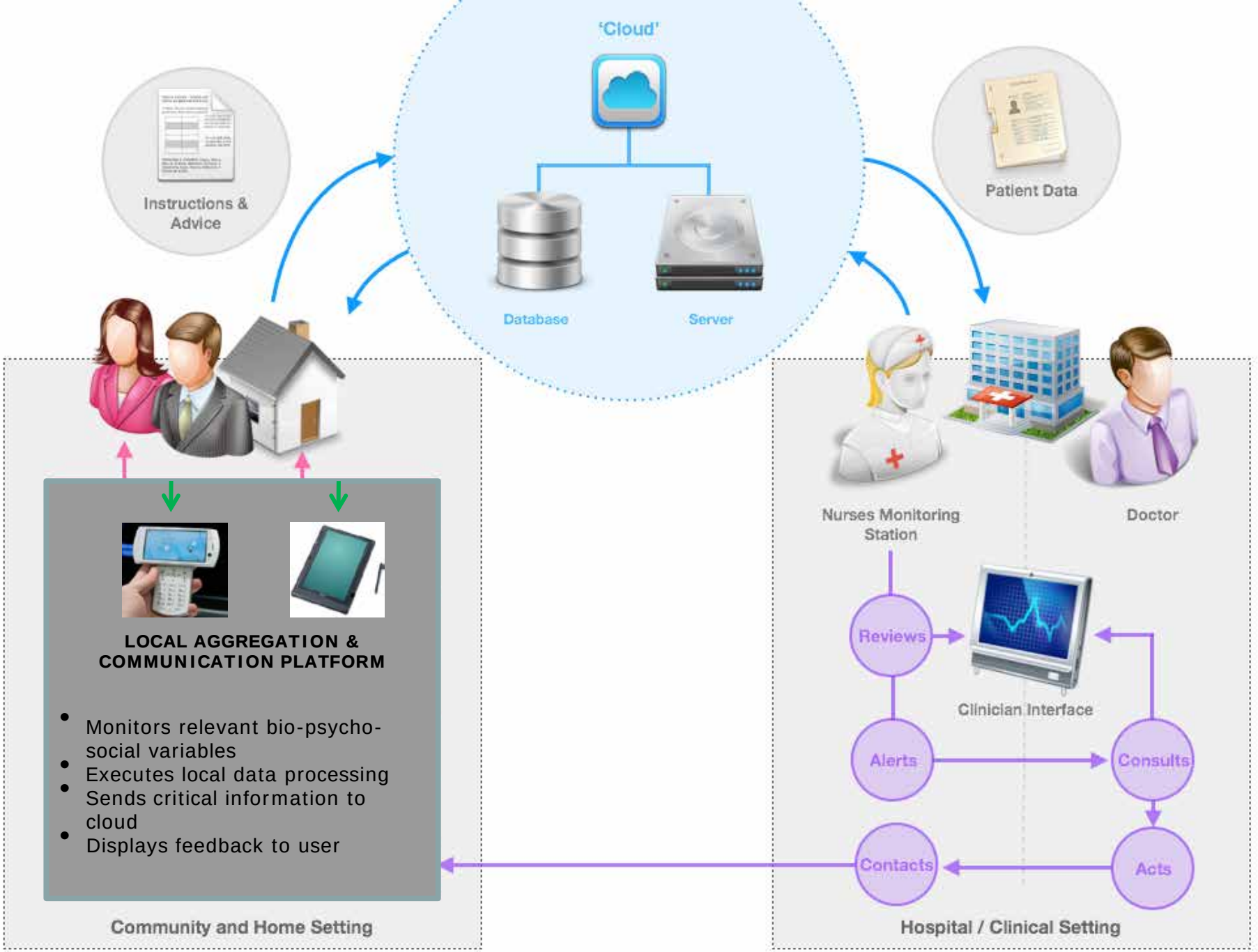
Home Based Care for COPD

- *Home based care can operate in different scenarios……*

- **Effective management of acute exacerbation**
  - Facilitation of **early supported discharge** from emergency room instead of admission to acute hospital or from inpatient care

- **Effective long term management**
  - Facilitating ongoing monitoring of critical clinical variables, compliance with therapy, and home based delivery of ongoing care

Technology Research for Independent Living


'Cloud'
Database
Server
Instructions & Advice
Patient Data
LOCAL AGGREGATION & COMMUNICATION PLATFORM
Monitors relevant bio-psycho-social variables
Executes local data processing
Sends critical information to cloud
Displays feedback to user
Community and Home Setting
Nurses Monitoring Station
Doctor
Reviews
Clinician Interface
Alerts
Consults
Contacts
Acts
Hospital / Clinical Setting

PHASE 1

combined data files
sent to clinical staff

Technology Research
for Independent Living

Pt Education

Quality of Life
Signs & Symptoms

Actigraphy
Resp Rate & Sleep Quality
Lung Function

Care Innovations Health Guide

Biancamed

Shimmer

Vitalograph

Analyses Performed

Data reviewed post hoc for potential indicators of exacerbations

Ethnographic evaluation of process, focussing on usability evaluation from patients and clinical staff

Evaluation of potential impact on future care pathways

careinnovations™ an Intel•GE company

BiancaMed

shimmer

Vitalograph® Your respiratory partner

Falls Risk Assessment & Prevention Research

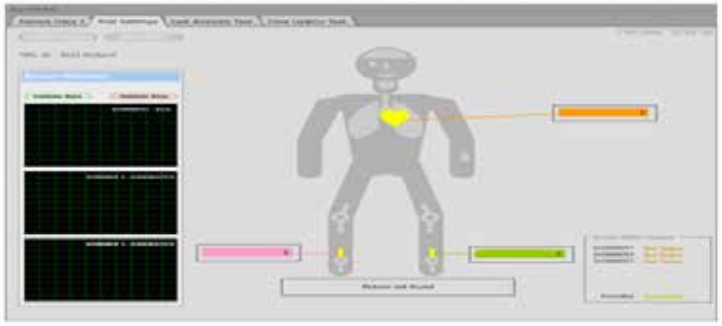
- Falls are a geriatric giant:
  - Significant causes of injury in the elderly
  - Approximately 28-35% of people aged 65+ fall, increasing to 32-42% for 70+
  - Frequency of falls increases with age and frailty level
  - The cost of falls in older adults expected to reach **$54.9 billion by 2020(1)**
  -
- Gait & balance parameters have utility in assessing mobility and balance impairments and can indicate risk of falling
- However, their use has been limited up to now doe to accessibility issues

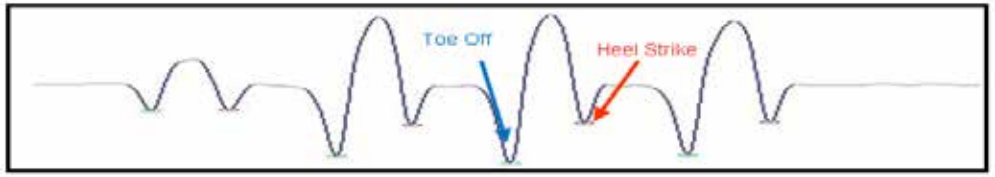
Technology Research for Independent Living

1) http://www.cdc.gov/NCIPC/factsheets/fallcost.htm

Motion Analysis Platform

- Development of wimu based motion analysis applications for falls risk assessment and evaluation
- Strong emphasis on usability for non-specialist clinicians and patients
- Deployment of platform in cohort for
  - Falls risk assessment using instrumented gait tests
  - Biofeedback during targeted exercise intervention for falls risk reduction



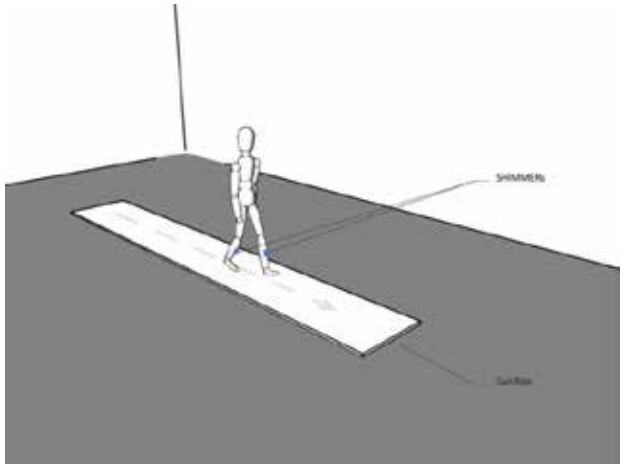


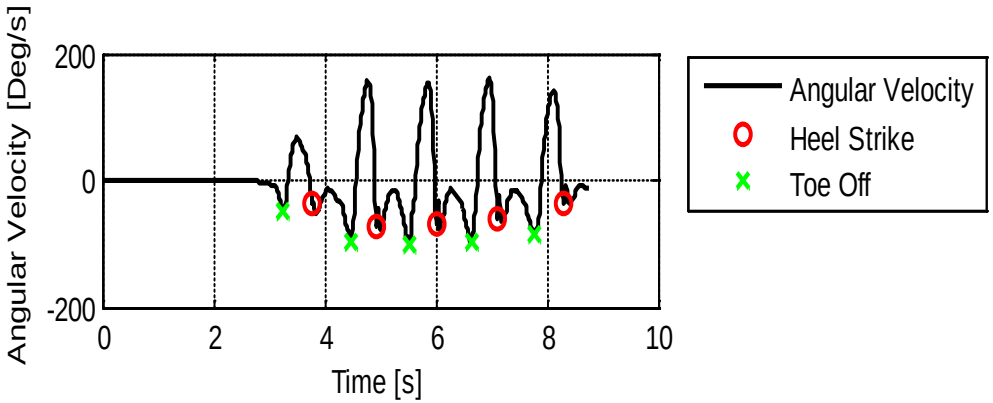
careinnovations™ an Intel • GE company

shimmer

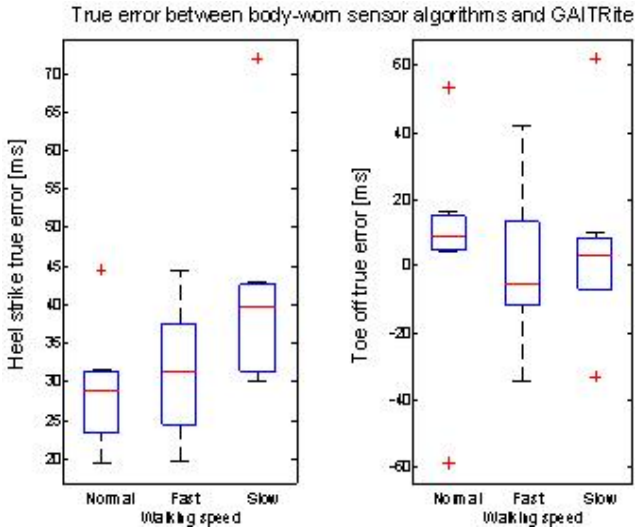
TRIL Technology Research for Independent Living

validation





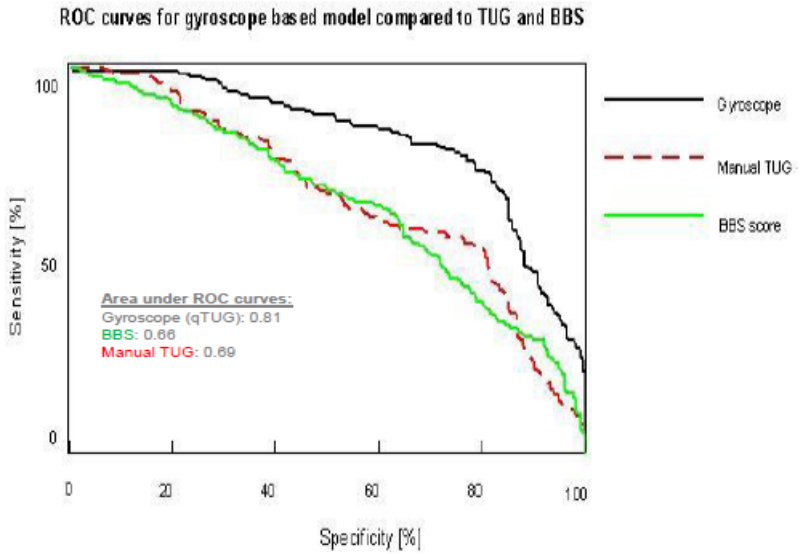
- Validation for measurement of temporal and spatial variables against gold standard systems
  - Marker based motion capture
  - Force platform
  - Pressure sensitive walkways

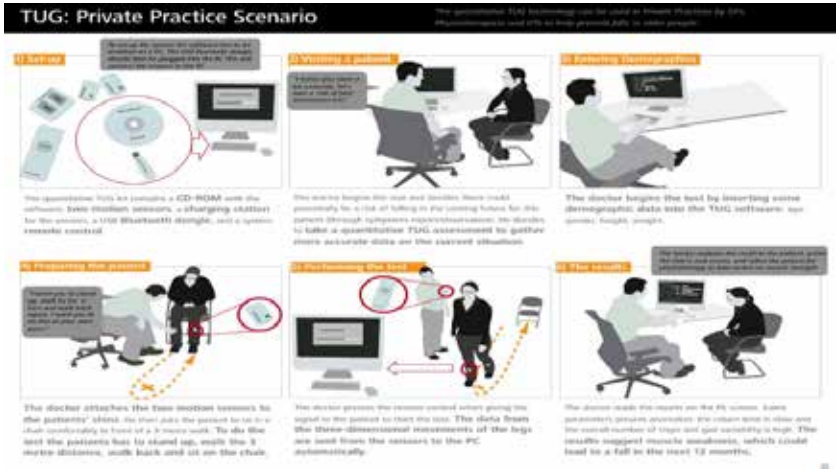


Technology Research for Independent Living

Instrumented TUG Test

- Evaluated against datasets from 349 volunteer participants
- Mean faller identification accuracy >80%
- Performs better than standard approaches
  - Standard TUG – 60.6%
  - Berg Balance Score – 61.4%

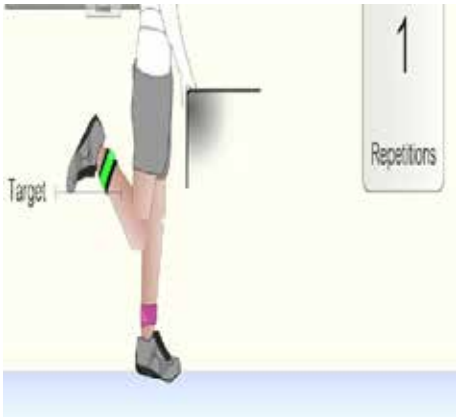


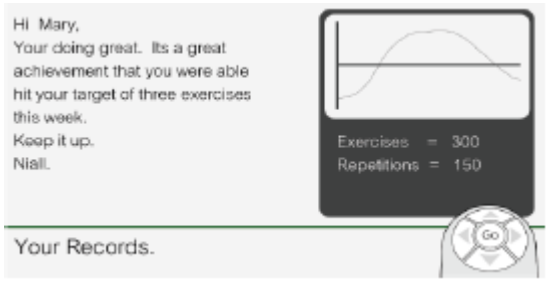


Technology Research for Independent Living

Fall Risk Reduction

Otago falls prevention exercise programme implemented using biofeedback system

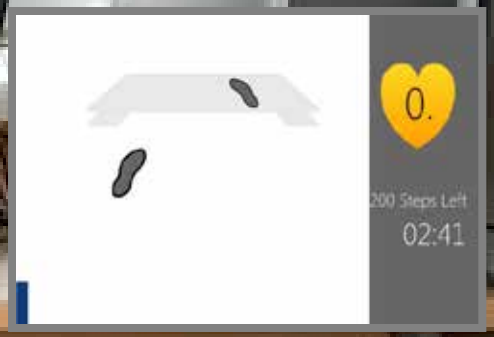




Technology Research for Independent Living


You are now in a call.
Press 'I want to make a comment' to interrupt the conversation
Fionúir Boyle
Press Me if you would like to make a comment.
Volume
Sheelin Burke
ringing
Go back to main menu.
Tea Room.
Fionúir Boyle
Síofra Byrne
Sheelin Burke
Teague Callaghan
Abhlach Carroll
Cullen Campbell
Enya Collins
More Contacts
Building Bridges
Leave Broadcast.
You are now in a broadcast.
Volume
Fionúir Boyle
Sheelin Burke
73 sec
Go back to main menu.
ToSheelin.
Send Message
a b c d e f g h i
j k l m n o p q r
ABC s t u v w x y z
. , ?
Space
Delete
TRIL
Technology Research for Independent Living
Create a Chat
Write a Message
Read Messages

Stepping Stones



Summary

- Multiple stakeholder input required
- Enabling platforms needed to facilitate convergence of academic, industry and clinical inputs
- Basic to applied research continuum needs to be addressed
- User centred design, development and evaluation is key to delivering user centred care
- Rewards are great if we are successful; converse also true

Technology Research for Independent Living

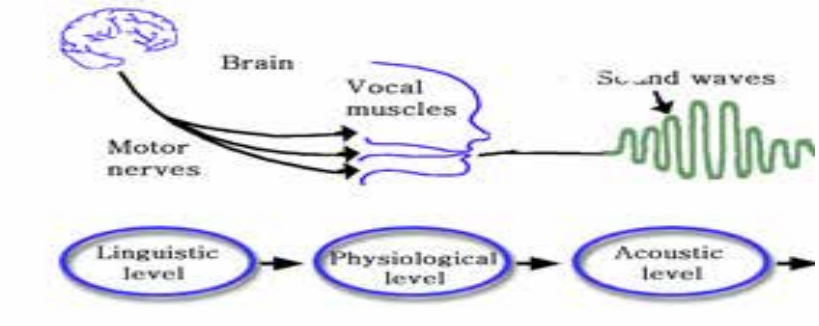
Thank You!

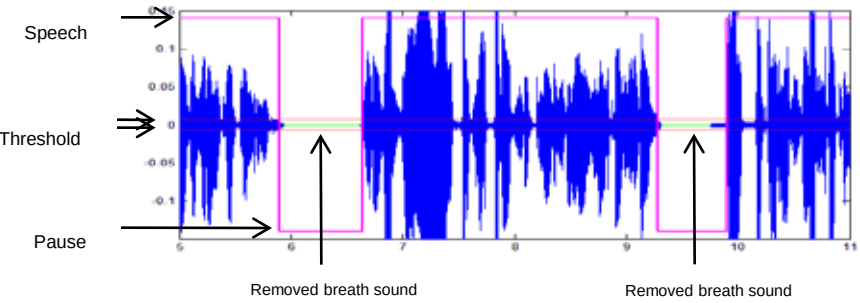
- For more information.....

- b.caulfield@ucd.ie

Telephone Cognitive Assessment

Development of an automated system for remote assessment of cognitive function using analysis of vocalisation, speech markers and mood.





Research Background

- Speech may provide a cost effective, easily implementable means of monitoring and assessing cognitive function

Research Questions

- Can the status of one's cognitive function be related to acoustic properties of speech?
- What is the protocol for successfully administering clinical cognitive assessments, remotely?

Research Activity

- Older people participate in various cognitive assessments while at home via the telephone.

  An Interactive Voice Response (IVR) system, conducts the assessment automatically.

  Analysis of the participants' speech is conducted for correlations to cognitive function.

Engineering Alertness

Development of a technology platform and training programme to support the improvement of attention alertness and focus in mature adults.

Research Background

- Declines in attention can lead to accidents, falls, and other negative consequences for elderly adults. Home based technology supports may provide an effective intervention.

Research Questions

- Can self reported states of attentiveness and alertness be improved through technology supported home based coaching?

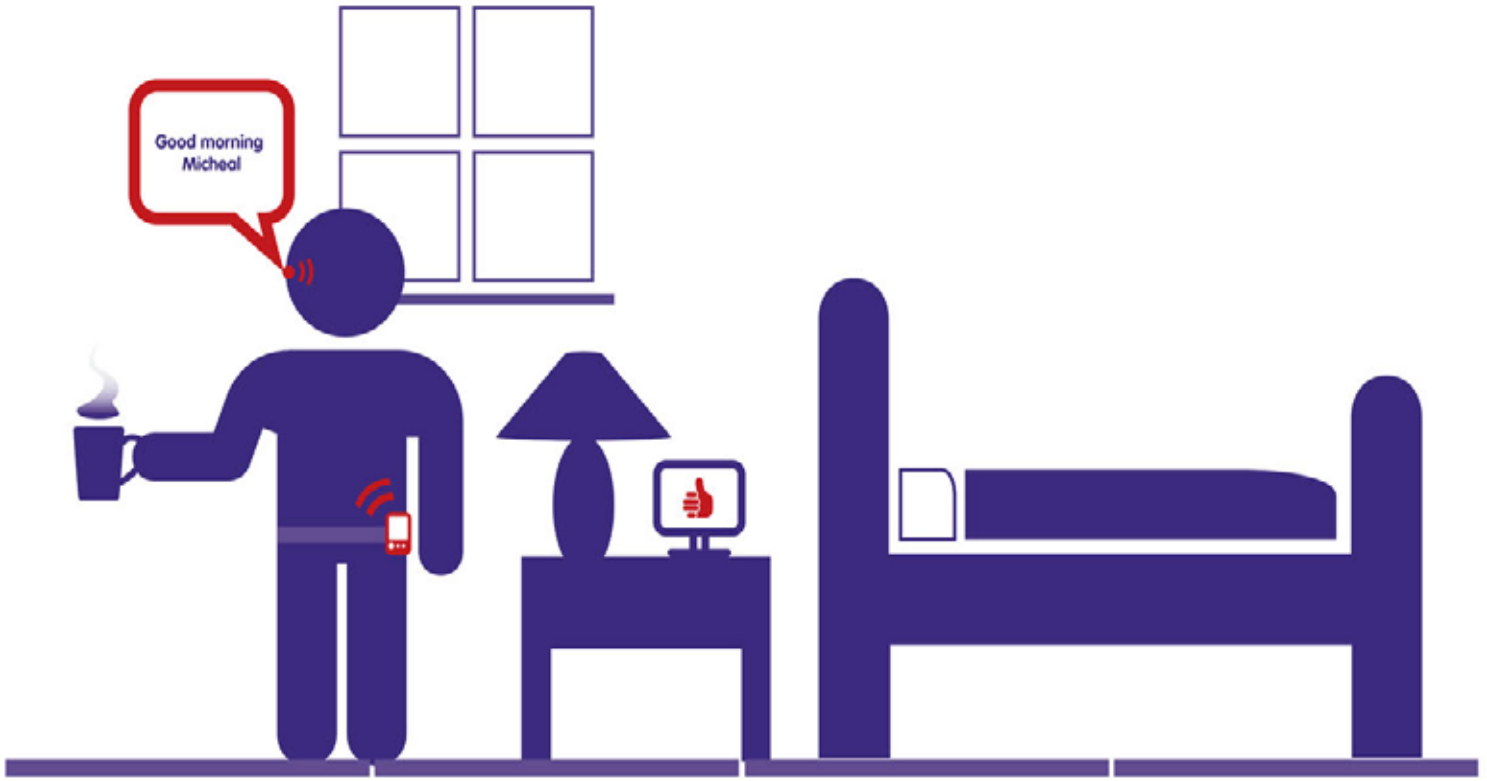
Research Activity

- In home mindfulness/attention training and coaching program
- Prototype Mobile biofeedback system use for biometric data capture and attention feedback

* *Using sensors integrated into a person's clothing, positioned around joints or on the floor, the monitoring system can provide accurate visual and physiological feedback of the person's physical activity and cardiorespiratory fitness during exercise.*

* *A visual display shows the exercises to be done by the person with either virtual feedback or real-time feedback from a physiotherapist.*

CAPSIL



* *By attaching an earpiece linked to the smartphone on his belt Sean can communicate with his family and friends with ease.*

* *Using the same device Sean can respond to helpful reminders from "Shiela" the voice of his interactive monitoring system.*

CAPSIL

* *For someone at risk of falls, sensor technology can be used to detect an obstacle on the floor.*
* *A signal is then sent to the person's Smartphone, which vibrates to warn them before they reach the obstacle.*

CAPSIL

* *A Smartphone can be integrated into a monitoring system in many ways!*

* *Although mainly considered a communication device for calls and email, it can also be used for diet planning, GPS tracking and sleep, exercise and heart rate monitoring.*

CAPSIL