Connected Health Cities

John Ainsworth
Director
Professor John Ainsworth, Director and Professor of Health Informatics, Connected Health Cities and University of Manchester

CHC INDUSTRY SHOWCASE EVENT
Health inequality between North and South England
What we worried about

1. Public attitudes to data reuse
2. Accessing data
3. Engaging with industry
4. Bridging service and research
5. Time to impact
6. Replication
7. Sustainability
What we found ... so far

1. Meaningful public engagement works
2. Data access is very difficult!
3. Choose projects and scale carefully
4. Analytic capacity is scarce
5. Insight without action is pointless
6. Creating a culture requires sustained activity
7. …makes replication work
8. This is not easy, but it is worth it
Public, Patient Involvement & Engagement (PPIE) @ Connected Health Cities

Debbie Parkinson
Patient & Public Involvement Lead

Jim Organ
PPIE representative
“No decision about me, without me”
I can't say I'm entirely pleased with my hip replacement.
Patient/public engagement and involvement

The role of the patient/public is no longer as a passive recipient of care. Nowadays we are all expected to engage patients in their own health, care and treatment. There are also a number of initiatives to encourage patient involvement in the design, planning and delivery of health services.

Connected Health Cities - We will build on this to include research and Industry ‘TRUST’
How?

• Public Survey (designed by PIES)
• Citizen Juries
• 1:1 Interviews with patients in hospital clinics and groups
• Patient support groups
• Co-production/design with Industry/SMEs
• Patients at events and meetings
Our Public Involvement and Engagement Senate (PIES)
#DATA
SAVES
LIVES
North West Coast CHC

Towards Learning Health Systems

Prof. Mike Pearson, Professor of Clinical Evaluation
Dr. Dennis Kehoe, CEO, AIMES
The story so far ...

Hospital Data

4.1 million residents

3 Years

Trustworthy Environment

Secure Storage and Access

Feedback

Clinical Outputs

Analytics Lab & Local Clinicians Algorithm

University of Liverpool
CHC ARK – Trustworthy Research Environment

**ISO 27001 Certified / IG Compliant (Level 3 100%)**

**Data Provisioning Zone**
- Database Server
- SFTP Server
- Digital Airlock

**Analytics Zone**
- VDI Broker
- Active Directory
- RRAS / AD
- Quad Core 2.7Ghz
- 48GB Ram
- 1TB Storage

**Local Flows**
- SUS
- LF

**Local Provider Data**
- Acute
- Ambulance
- Community
- Demand for Service
- Other data
- Diagnostic Services
- Emergency Care
- Mental Health

**Secondary Uses Service (SUS)**

**Patient Identifiable data flow**

**Pseudonymised data flow**

**Managed OS**

**Antivirus Running**

**Patched and Updated**

**Digital Airlock**

**File Server**

**VDI Broker**

**Active Directory**

**RRAS / AD**

**Disclosure Control Policy**

**Digital Flows**

**ETL**

**Database Server**

**Managed OS**

**Antivirus Running**

**Patched and Updated**

**ISO 27001 Certified / IG Compliant (Level 3 100%)**

**Data Sharing Agreement**

**Analyst**

**Mandatory Training**
- Data-Protection Act
- IG Training
- MRC Safe Researcher Training

**Institution Level Data Sharing Agreement**

**VPN**

**SFTP Server**

**Duo 2FA**

**Quad Core**
Alerts on Clinical Systems in Real Time

Local Clinicians & Data

Learning Health System

Analysis & Mapping

Link to Lab Results

Target Services
Learning Health Systems

Learning implies having something to learn from i.e. knowledge

Data -> Information -> Knowledge

Our process

• Identify cohorts that clinicians recognise - decode SUS into what the coders saw.
  • FINDS: Larger numbers, varied severity, higher mortality, greater specificity
• Use mapping (adjusted) to demonstrate disease “hotspots”
• Understand and characterise hotspots and share clinically
• Discuss pathway, encourage local clinical and service discussion
• Create solution and use informatics “feedback” to prompt actions
• Monitor changes with continuous data

.......
Medical Practice must utilise new technology to its full advantage

Think of how computing has changed driving?

Medicine has been left standing

- 1 to 1 versus groups
- Linking data
- Sharing information
Why is our data analysis better?

Data Capture

Coding

Analysis

Alcohol Related Liver Disease

Standard Method:

6 primary codes

1,667 Admissions

CHC Method:

76 primary codes

3,060 Admissions

K700 Alcoholic fatty liver
K701 Alcoholic hepatitis
K702 Alcoholic fibrosis and sclerosis of liver
K703 Alcoholic cirrhosis of liver
K704 Alcoholic hepatic failure
K709 Alcoholic liver disease unspecified

K18X Ascites
K920 Haematemesis
I850 Oesophageal varices with bleeding
K922 Gastrointestinal haemorrhage unspecified
I859 Oesophageal varices without bleeding
D649 Anaemia unspecified
K921 Melaena
K625 Haemorrhage of anus and rectum
R17X Unspecified jaundice
K767 Hepatorenal syndrome
I864 Gastric varices
K766 Portal hypertension
E871 Hypo-osmolality and hyponatraemia
E876 Hypokalaemia
E162 Hypoglycaemia unspecified
R600 Localized oedema
E86X Volume depletion
I851 Orthostatic hypotension
N19X Unspecified renal failure
R945 Abnormal results of liver function studies
E872 Acidosis
I982 Oesophageal varices in diseases classified elsewhere
E46X Unspecified protein-energy malnutrition
Why is our data analysis better?

Coding

Analysis

Standard Method: Basic Counting

10 Patients with Alcohol Related Liver Disease
Why is our data analysis better?

CHC Method: Identification of case mix

2 Falls
3 Intoxication
3 Varices
2 Ascites
Why is our data analysis better?

Conversion Rate (AED to Admission)

Short Stay (0/1 day admissions) v Longer Stay

Frequent Flyer (Short Stay v Longer Stay)

Clinic Non-attendance

Presentation Patterns

Data Capture

Case Mix

Patterns
We identify **all** of the patients in a disease area

We demonstrate different stages within a disease

We track patients through the health system

We reveal hotspots of disease activity
Emergency bed days for alcohol-related liver disease for Wirral University Teaching Hospital NHS Foundation Trust: Local Hot Spots

The green area represents the ‘catchment area’ for all-cause emergency admissions for the hospital. In 2014/15 - 2016/17, there were 652,339 emergency bed days for residents of this area.

The areas shaded in red are the 10% of LSOAs with the highest crude count of emergency bed days for alcohol-related liver disease (23 out of a total of 233 areas in the catchment). Patients resident in these 23 areas accounted for 38% of all bed days for ARLD.

The total number of bed days for ARLD in the catchment area for 2014/15 - 2016/17 was 10,368. This suggests that on average there were 9 inpatient beds per day occupied by cases of ARLD at this Trust.

NOTE: Each LSOA identifies an area with a population of approximately 1,500 residents.
# EMERGENCY ADMISSIONS ACTIVITY

**Wirral University Teaching Hospital NHS foundation Trust**

These data summarise total emergency activity based on counts of emergency admissions. For each fiscal year, all completed spells are counted. Data are presented for your Trust and, where relevant, compared with aggregated data for 7 Trusts in the Mersey and Cheshire area (mean values for all Trusts, unless stated otherwise).

<table>
<thead>
<tr>
<th></th>
<th>All cause(^1)</th>
<th>Alcohol Any(^2)</th>
<th>Alcohol Primary(^3)</th>
<th>ARLD Primary(^4)</th>
<th>ARLD Algorithm(^5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. of admissions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14/15</td>
<td>39,867</td>
<td>2,961</td>
<td>884</td>
<td>161</td>
<td>355</td>
</tr>
<tr>
<td>15/16</td>
<td>39,243</td>
<td>2,152</td>
<td>608</td>
<td>141</td>
<td>273</td>
</tr>
<tr>
<td>16/17</td>
<td>39,807</td>
<td>2,947</td>
<td>674</td>
<td>156</td>
<td>287</td>
</tr>
<tr>
<td><strong>% Short stays (&lt; 2 days)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14/15</td>
<td>49.2 (50.8)</td>
<td>45.8 (50)</td>
<td>35.4 (40.5)</td>
<td>10.6 (12.1)</td>
<td>15.5 (16.5)</td>
</tr>
<tr>
<td>15/16</td>
<td>49 (49.9)</td>
<td>45 (47.5)</td>
<td>42.6 (43.3)</td>
<td>10.9 (12.6)</td>
<td>18.2 (16.9)</td>
</tr>
<tr>
<td>16/17</td>
<td>47.4 (50.9)</td>
<td>45.1 (48.2)</td>
<td>47 (43.7)</td>
<td>6.5 (12)</td>
<td>13.2 (16.5)</td>
</tr>
</tbody>
</table>

The following data reflect mean variables for your Trust and for Cheshire and Merseyside aggregated across the three fiscal years:

- **Age**: mean = 61.7 (60.3), 51.9 (51.2), 48.3 (48.2), 52.5 (52.3), 52.2 (51.9)
- **Gender**: % female = 55.5 (54.4), 32 (33), 32 (32.9), 36.1 (37.1), 35.6 (35.9)
- **Deprivation**: mean = 13,336 (11.512), 8,172 (7.666), 7,861 (7.818), 9,534 (8.408), 8,654 (8.196)
- **Charlson**: mean = 0.9 (0.8), 0.7 (0.6), 0.5 (0.5), 1 (1), 1.1 (1.1)
• What to do with the data

• Alcohol – working with Blackpool Trust BI team to recreate inside trust – link to labs and other data

• USE the information to create real-time alerts for clinicians when patients present to hospital

• Could this be the first step toward our medical satnav to travel pathways?
Why is our data analysis better?

COPD Admissions in the Wirral Population
Age-Adjusted Rate

COPD Admissions in the Wirral Population
Hotspot Clustering and GPs

Why is our data analysis better?
Identify COPD hotspots

• Hotspot of 7500 people: 3x the mean area admission rate
  Deprivation, younger, smaller practices and other factors

• Options:
  Create a focused outreach from hospital
  Re-focus the community service
  Offer LUNGHEALTH to help improve the nurse-led
  COPD clinics

Solve the hotspot and then can apply to rest of locality
AND the CHC is monitoring if its working.....
Days to Outpatient Appointment

Proportion with appointment within 3 months

With nurse support

Without nurse support
Opportunities

• Turning data into information that clinicians believe, can work with, and offer to feed back on progress = first step learning health systems.

• We think our algorithms can help other regions similarly

• We have a working TRE – but its not really research but bringing out the knowledge within the data and making it available to the clinical process.

• There are many more topics to be covered.... ...and we have new bids in train eg Mental Health.

• National interest eg from “GIRFT” teams  and from our STPs

• We have acquired technical partners with skills to help

• We want to gain permission to link more data.... ... but within GDPR.
BRIT: Optimising antibiotic prescribing in primary care

Chirag Mistry
Tackle antimicrobial resistance by improving the quality of antibiotic prescribing through the application of data analytic techniques.
Traditional Research vs CHC model

Data → Research → Publication → Feedback

Icon source: www.flaticon.com
BRIT Timeline

- **Sep 2016**: BRIT Starts
- **Feb 2017**: Engagement with GPs and wider healthcare community
- **Feb 2017**: Realisation of a need for outside expertise
- **Jun 2017**: Relevant source of funding found (MRC Proximity to Discovery fund)
- **Aug 2017**: Partnership with Imosphere begins
- **Present**: Preparing for first release
The BRIT platform

BRIT dashboard - visuals showing detailed analysis tailored to help advise prescribing.

Atmolytics - application to build datasets, explore and generate personal insights.
## Benefits for both sides

<table>
<thead>
<tr>
<th>Academic team</th>
<th>Industry partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ Enhances the BRIT offering</td>
<td>➔ Understanding of the academic utility for their product</td>
</tr>
<tr>
<td>➔ Sharing ideas and insight</td>
<td>➔ Access to influential stakeholders</td>
</tr>
<tr>
<td>➔ Joint funding opportunities</td>
<td>➔ A route to market</td>
</tr>
</tbody>
</table>
Conclusion

"Coming together is a beginning, staying together is progress, and working together is success."

Henry Ford
Self-management support in primary care for older people

Sujo Anathhanam
Clinical Lead

&

Kuldeep Sohal
Programme Manager
Understanding frailty

Condition characterised by vulnerability to adverse outcomes

Fit      Mild frailty      Moderate frailty      Severe frailty

Increasing frailty
Clinical presentation of frailty

Clegg A, Young J, Illife S, Rikkert MO, Rockwood K.

Lancet 2013;381:752-62
Electronic Frailty Index

Proportion alive

Time

Clegg et al.
Age Ageing
2016;45:353-360

Fit
Mild frailty
Moderate frailty
Severe frailty
Aims

• Test collaborative working between primary care and VCS

• Recruit 100 older people at risk of mild frailty and ‘high users’ of primary care

• Measure self-rated self-care and staff/service user satisfaction with service

• Undertake exploratory analyses of healthcare utilisation
cYorkshire database and Apollo

• Aims to develop a linked database using electronic routinely recorded healthcare data
• Data sharing agreements with 88 general practices
• Apollo Medical Software Solutions Ltd. using “black box” software to extract pseudonymised data at source
• Data held securely at Bradford Teaching Hospitals NHS Trust
Intervention delivery

• Eligible people were:
  — over 65 years
  — at risk of mild frailty using eFl
  — high users of primary care.

• Invitation letters sent out by the practice.

• Offered consultation with an Age UK Supporting Self-Care coordinator
Service provision

• Guided conversation
• Motivational interviewing techniques
• Individual plan agreed
• Further support and signposting to local services where needed
Results: take up

• 168 people were offered the intervention
• 108 expressions of interest
• 106 people took up the offer
• 52% female; 48% male
• No significant differences between those who took up the intervention and those who didn’t
Ages of service users
What did the offer look like?

106 took part

- 95 face to face consultations
- 11 telephone consultations
- 25 follow up telephone consultations
- 1 additional face to face consultation
- 2 additional face to face consultations
# Self-management ability

<table>
<thead>
<tr>
<th>Time</th>
<th>Total scores</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (BL)</td>
<td>78.07 (11.73)</td>
<td>BL vs 3 months: 0.62</td>
</tr>
<tr>
<td>3 months</td>
<td>78.60 (12.32)</td>
<td>BL vs 6 months: 0.39</td>
</tr>
<tr>
<td>6 months</td>
<td>79.61 (11.98)</td>
<td>3 vs 6 months: 0.77</td>
</tr>
</tbody>
</table>

87 questionnaires at baseline,  
70 3 month questionnaires, 65 6-month questionnaires  
67 questionnaires at all 3 time points (63%)
Healthcare utilisation

• Pseudonymised data provided by GP practices and BTHFT for:
  – Intervention group at SMP
  – Control group at BMP
• For each case and control healthcare utilisation measured at 4 time periods:
  – 6 to 3 months before baseline
  – 3 months before and up to baseline
  – Baseline to 3 months later
  – 3 to 6 months after baseline
• Statistical support from University of York
• Used difference in difference estimation
Healthcare utilisation: GP visits

- 3-6 months before
- 0-3 months before
- 0-3 months after
- 3-6 months after

Controls
Cases
Limitations ...

- Baseline differences in healthcare utilisation despite matching
- Small numbers
- Short follow up period
- Social care data inadequate
- Secondary care visits too sparse to analyse meaningfully
What did service users think?

“I came away feeling confident, very confident”

“Was surprised that with all the cost cutting the practice was able to offer this service”

“Just knowing that there is someone there and how to get in touch with them is a great help”

“I’ve addressed a lot of this stuff already”
What did staff think?

Challenges faced
- Sharing of information across services
- Administration
- Engaging older people at risk of frailty

Evolution of service design
- Population-level targeting in this group was unique
- Working as a collaborative partnership
- Development of communication approaches within the team

Working within current healthcare systems
- Engagement with local community services
- Current pressures on health services acknowledged
- Willingness to explore future relationships and service delivery
Findings and next steps

- Joint working between primary care and voluntary sector is feasible
- Larger study across more practices using data extracted by Apollo
- Refinement of target group
- Resource would be needed to support administrative aspects in practice
Comfort Break
Automated coding of clinical texts – a Spin-in Lab Exemplar

Zoher Kapacee
GM CHC Operations Lead
Greater Manchester
Connected Health City

Automated coding of clinical texts - a Spin-in Lab exemplar

Zoher Kapacee
(Zoher.Kapacee@manchester.ac.uk)
Aims

1. To continually improve and optimise the health and social care system to deliver better care, more efficiently, by providing actionable information to inform decision making at all levels.

2. To establish a social contract with the population that gives license to use healthcare data for the public good.

3. To accelerate business growth in the digital health sector for the benefit of the North of England.
IMO-Salford Automation of Clinical Coding

Aim: To automatically extract clinical codes from semi-structured and unstructured clinical texts

Organisations involved:
  - Intelligent Medical Objects
  - Salford Royal NHS Foundation Trust
  - The University of Manchester

Pilot study:
  - Outpatient letters from rheumatology unit
  - semi-structured lists of diagnoses
  - comparison with manual coding by clinical experts
  - Demonstrate the value proposition of accurate clinical coding
Pre-Competitive Collaborative Consortium (PCCC)

Dipak Kalra
Director of External Stakeholder Relations
Aims of CHC-industry engagement via the PCCC

1. For the CHC and multiple industry sectors to co-create and validate innovative solutions that
   • bring benefits to patient care and health service effectiveness
   • accelerate the capability to conduct research

2. For these innovations, and their embedded products and services, to be sustainable and scalable across the north of England, nationally and beyond

3. Through the above to attract industry funding and job creation to the north of England, and act as a national exemplar of public private partnerships in action
Objectives of the PCCC

• To tackle common problems in health technology: research, innovation, procurement, and delivery, creating a vibrant market that rapidly applies technology to improve health

• To create an environment where commercial organisations can build generic solutions and deliverables for the health ICT market

• To co-create and share early insights into new opportunities for the deployment of eHealth, pHealth and mHealth products and services as well as identify the need for new innovative solutions

• To do this within a trusted eco-system enabling the co-creation and internal sharing of the solutions and findings of the PCCC
Benefits to participating industry

• Becoming a member of the PCCC will give industry members favourable access to the growing market for health ICT products and services across the north of England, because they will:
  • work with care improvement champions to shape ICT innovations and have confidence in their adoption
  • gain early insights into the strategic direction of future care services
  • engage with patients and the public in the design, testing and adoption of mHealth and pHealth solutions
  • co-create generic enabling solutions
  • benefit from engagement in care pathway projects
  • have early access to new market opportunities
  • get better access to stakeholders in all CHC regions and to common platforms which all CHC parties will adopt (e.g. the use of standards, governance frameworks, Arks)
Benefits to the CHC

- To help shape the design of innovative ICT products
- To benefit from industry partner know-how and favourably-provided products
- To benefit from generic enabling solutions created by the consortium
- To trial novel products within improved care pathways in an experimentation environment
- To benefit from in-kind as well as in-cash industry contributions
PCC Membership

• Open to any companies that are relevant to the mission and development of the CHC
• Initial term of membership is 12 months
• PCCC membership normally reviewed every 12 months, when new entrants may be admitted
• Industry members are complemented by City Region and CHC Hub members
• The CHC is legally represented by the University of Manchester, within the PCCC Heads of Terms and Consortium Agreement, to which the other CHC public partners are co-signatories
• The PCCC will continue to exist and further develop after the CHC grant has ended, subject to adequate funding streams to sustain it
The PCCC deliverables

- The agreed co-created enablers of innovation and adoption are developed by public and industry members working in short-term project teams, utilising a mixture of in-kind and in-cash resources that have been contributed by its members.

- Each project team is responsible for ensuring compliance with any ethical, legal or regulatory requirements applicable to its work.

- Unless otherwise determined by the consortium members, each deliverable is jointly owned by the full PCCC membership.
PCCC Deliverable projects 2018

Championing change and adoption of innovation
Working with change champions to define and promote the success factors that embed innovations within NHS culture and workflows

Sustainability
Experience of effecting local NHS change

Transferability
Validated evaluation metrics

Evidencing the benefits of innovation
Working with early adopter sites to capture marketable metrics of value: health outcomes, financial, technical maturity, policy alignment

Piloted ICT-driven innovations
NHS, academic, industry and public perspectives on the needs for innovation and barriers to uptake

CHC care pathway projects

Scalable ICT-driven innovations
Organisational change success factors

Learning health systems
Market growth

NHS, academic, industry and public perspectives on trusting the value of innovations proven “elsewhere”

CHC Kite Marking of ICT solutions

PCCC Deliverable projects 2018

15.2 million people
8 NHS sites
8 Universities
4 AHSNs
DoH £20m 3 year pilot project

NHS, academic, industry and public perspectives on the needs for innovation and barriers to uptake

Organisational change success factors

Market growth

Learning health systems

CHC Kite Marking of ICT solutions

NHS, academic, industry and public perspectives on trusting the value of innovations proven “elsewhere”

PCCC Deliverable projects 2018
Change Champion Deliverable

Dipak Kalra &
Zoher Kapacee
Championing change and adoption of innovation

• **AIM**
  • To exchange experiences and identify best practices that drive digital innovations into clinical practice

• **OBJECTIVES**
  • To gain multi-stakeholder understanding of the eHealth and pHealth innovation needs in various healthcare settings
  • To explore best practices, associated risks and challenges with the adoption of any digital solutions into clinical practice
  • To understand how to achieve ‘buy-in’ from NHS decision makers; what are the motivations to invest, as well as associated regulations and timescales involved for adoption
  • To ascertain the commercial value of unmet clinical needs and the opportunities for CHC industry partners to address these needs
  • An understanding of the components needed to deliver the desired solution for the NHS
Framework for capturing change challenges

- Define the problem
- Design the intervention
- Develop the intervention - ICT and infrastructure
- Prepare the intervention - people and organisations
- Implement the intervention
- Sustain the intervention
Kite Mark Deliverable

Ian Sharp

CY CHC representative, DHEZ CEO
Kite Mark Deliverable

• Identify the requirements for effective, successful transfer and adoption of projects across the CHC regions.

• Core components required to show the level of development, maturity, alignment with policy and potential positive impact of this approach are believed to be on;
  1. Health,
  2. Wealth,
  3. Technology & Maturity, Assessment
  4. Policy and
Guest Speaker
David Hughes
Innovation Agency
Digital Health in the North

Dr David Hughes, Director of Strategic Partnerships, Innovation Agency

4 July 2018
Northern Powerhouse

AHSNs, NHSA & CHC

Local Assets

Investment

The Opportunity
Landscape

National Initiatives
- LHCRE Sites
- Digital Innovation Hubs
- Life Sciences Industrial Strategy
- Data Services Platform
- HDR UK Sites

National Challenges
- Access
- Data
- Consent
- Interoperability
- Funding

Local Asset Base
- 8 GDEs
- NHSA & CHC
- Progress on national challenges
- 2 Digital Enterprise Zones
- 3 Test Beds
DHN will address national challenges by **supporting local solutions**. It will **signpost, navigate and spread best practice of innovation for the NHS, industry & SMEs**. As well as **making the north an attractive place to do business**.
Germany 1 - 0 Italy
16:44

Pass Completion
91.8%

Ball Handling
0
Saved
3
Shots on Goal
146 / 159
Successful Passes / Total Passes

Pass Completion
90.5%

Ball Handling
0
Saved
3
Shots on Goal
95 / 105
Successful Passes / Total Passes

Ball Possession Rating
55.0%

Ball Possession Time
6:45

Ball Possession Rating
41.0%

Ball Possession Time
5:39
Data is a necessary but not sufficient condition

We need to create the right environment:

- For industry and SMEs
- For data sharing and consent
- To enable linkage which is key

But data provides no value if we keep it locked in a vault - balance between risk and value added is key.
We need to know what works and what doesn't.
The end of information asymmetry?

• The challenge used to be how do we fill the information gap

• The question now is how do we process so much information and data

“we have produced more data in the past 2 years than in the whole of human history”
Data and the 4 Vs

- Scale of Data
- Different forms of Data
- Analysis of Data
- Uncertainty of Data

Big Data

- Volume
- Variety
- Velocity
- Veracity
VAR

VIDEO ASSISTANT REFEREE
• Velocity
• Veracity
• Volume
• Variety

VALUE
What will be the key next challenges?
- Consent
- Secondary uses
- Not misleading the public
- Understanding the difference between anonymous and identifiable data
For further information please contact

carol-ann.costello@manchester.ac.uk