Digital Economy
A Global Public Health Frontier

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This Talk

• Whose eHealth? Whose Digital Economy?
  *Citizen, Patient & Population*
  ...
top-down or bottom-up?

• Public eHealth R&D in Northwest England
  *Open Health e-Labs programme*

• Crossing the Digital Divide
  *Affordable, sustainable digital commodities for enterprising public health, globally*
What is Digital Economy R&D?

Novel design or use of technologies to help **transform** the lives of individuals, society or business.

Nicholas Negroponte 1995: “…from processing atoms to processing bits”
UK Health Systems Dilemma

Society’s Health-Needs

- healthy choices opportunity & responsibility
- prevention or bust
- early intervention
- "world class" commissioning
- personalised care & access
- reducing inequalities
- Self-care opportunity & responsibility

Long-term
Strategic for sustainability
Short-term
Do we choose health?
Situational Awareness of Rising Child-BMI: Example Wirral 3-yr-olds from 1988 to 2004

SDS = standard deviation score from 1990 British Growth Reference charts – adjusts for age and sex of the child
Wirral (0.3M), UK

Child poverty map
(households with children: % on benefits in 2001-3)

Fifths of IDAC 2004
Red (light) = most deprived
Red (dark)
Purple
Blue (dark)
Blue (light) = most affluent
Fifths of BMI
SDS BMI fifth
Red (light) = fattest
Red (dark)
Purple
Blue (dark)
Blue (light) = thinnest
BMI of 3 yr olds
1990 - 1991

Fifths of BMI
SDS BMI fifth
Red (light) = fattest
Red (dark)
Purple
Blue (dark)
Blue (light) = thinnest
BMI of 3 yr olds
1992 - 1993

Fifths of BMI
SDS BMI fifth
Red (light) = fattest
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BMI of 3 yr olds
1994 - 1995

Fifths of BMI
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**Fifths of BMI**
SDS BMI fifth
- Red (light) = fattest
- Red (dark)
- Purple
- Blue (dark)
- Blue (light) = thinnest
BMI of 3 yr olds
2000 – 2001

Fifths of BMI
SDS BMI fifth
Red (light) = fattest
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Blue (dark)
Blue (light) = thinnest
Secular trend to increasing BMI is much greater in taller children

Source: Buchan et al. 2006
Rise in BMI and fall in cardio-respiratory endurance of Liverpool 10 year olds from 1998 to 2004

Data from G Stratton, Liverpool Sportlinx
Cardio-respiratory endurance levels of Liverpool 10-yr-olds fell in all BMI groups

Data from G Stratton, Liverpool Sportslinx
Type 2 diabetes incidence in a typical health economy

New type 2 diabetics in Salford
...these were all signals from routinely-collected NHS data

Beware ‘data-tombs’...
Digital Dust (data deposit > use)

NHS & Partners’ Data Tomb

Finance

Clinical

Public Health

Research

Deposit

Use
Cloud of millions of NHS messages in the local health economy

Organise

Structured Data

Transform & Examine

Structured Data & Metadata
What is an e-Lab?

...an information system bringing together data, analytical methods and people for timely, high-quality decision-making
Clinical audit question: “is diabetes care picking up enough treatable anaemia in patients with mild kidney impairment?”
→ Answer: No
→ Care pathway improvements
→ Next similar e-Lab query made easier
→ Deeper research...
Anaemia at lower levels of kidney impairment than commonly thought

Clinical (audit) questions leading to scientific findings: supporting sustainable healthcare-academic partnership

Anaemia at lower levels of kidney impairment than commonly thought
Dataset ➔ Digital Commodity

Serving health communities with high-quality health intelligence requires metadata from local uses...
Excellent research becomes a by-product of excellent service development.

- Local NHS
- e-Lab
- Research Networks
- Research

Service development

Federation of e-Labs → scalable & sustainable
Gene Association Studies

Which genetic variation is responsible for disease variation

Single nucleotide polymorphisms (SNPs)

Human genome = 3 billion bases ⇒ 3 million sites of variation

The challenges of personalised medicine outstrip our ability to use the data from current biotechnologies
1) Simple Algorithms

\[ C = \sigma^2(I + ABB^T) \]

2) Simple Algorithms

\[ C = \sigma^2(I + ABB^T) \]

3) NIBHI & Microsoft Shared Genomics developing next generation software

Computational free-thinking, for insights from richly-observed health & environments
...the e-Research Digital Economy
Optimising Health Systems in a Digital Economy

Real-time views of health(care) enriched by local knowledge, and smarter predictive models
Summarising care quality

Total Cholesterol

1993 1995 1997 1999 2001 2003 2005 2007

Systolic BP

Care improvement or case-mix change?
Developing models and software to make complex scenarios easy to explore → democratise commissioning?

Outputs: Population-based incidence, prevalence; Deaths prevented; Life-Years; Life expectancy; Costs; Cost-effectiveness ratios
Standards-based Health Information Systems

**e-Lab: Sense-Making Layer**

Open Source Projects Sustained by the Value they Add through Crowd-Wisdom (e.g. [www.opencdms.org](http://www.opencdms.org))

- Care
- Service Development
- Research

Systems

Communities

Individual Citizens
Equipping citizens

Individuals and communities harnessing digital economy services for feeling well and preserving health
Do Nothing is Not an Option

• **Markets** offer more **unhealthy** than health products and services

• **Healthcare** is too **late** and **inaccessible** for maximum potential health gain

• **Wellbeing** and **healthcare** interventions are too **impersonal** to be fully-effective
Re-wire the brain to resist over-malnutrition?

Burning Fat

Depositing Fat

(ketone/other) molecules on skin

Active Polymers in wristband +/- other signals & data

Frequent Choices
The Wellbeing Digital Economy is Growing
Digital Divide

• High-cost niche technologies
  – Tooling up the worried well
  – Inequalities in health increase
  – Isolated creativity

• Low-cost widespread, open technologies
  – Affordable for most citizens and nations
  – Social network leverage for citizen-led health
  – Large creative pool → rapid emergence
Harness Digital Economies via PHI

- **Sense-Making**
- **Health and Social Care**
- **Wellbeing**

- Global Creativity & Understanding (motivation/ownership)

- Open-Source Integration & Analytics (state-of-the-art) + Public eHealth architectures

- Public Funds (Global N > S)
Conclusion

Digital Economy is a public health frontier

– Novel prevention
– Citizen-driven care
– e-Epidemiology
– Risks (e.g. digital divide)

– PHI has a great opportunity to harness and shape the Digital Economy for global public health