MANCHESTER 1824
The University of Manchester

The University of Manchester Research

Health e-records and the Obesity Epidemic

Link to publication record in Manchester Research Explorer

Citation for published version (APA):
Buchan, I. (2006). *Health e-records and the Obesity Epidemic*. British Computer Society Seminar, Manchester.

Citing this paper
Please note that where the full-text provided on Manchester Research Explorer is the Author Accepted Manuscript or Proof version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version.

General rights
Copyright and moral rights for the publications made accessible in the Research Explorer are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Takedown policy
If you believe that this document breaches copyright please refer to the University of Manchester's Takedown Procedures [http://man.ac.uk/04Y6Bo] or contact uml.scholarlycommunications@manchester.ac.uk providing relevant details, so we can investigate your claim.

OPEN ACCESS

Download date:08. Jun. 2022

Health e-records and the obesity epidemic

Iain Buchan
The University of Manchester
buchan@manchester.ac.uk

BCS Seminar May 2006

Presentation

- Obesity – 'heads up' the evidence production line is out of date
- Health e-records feeding discoveries
- Need e-records to support metabolic health
  - Population
  - Clinical
  - Personal

Health evidence journey

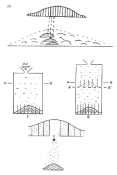
Mid 1600s: John Graunt used death and tax data to inform civil action as plague swept London

Circa 1800: Laplace then Louis apply probability theory to medical data, showing some treatments to be ineffective - rebuked by medical profession – Quetelet's concept of 'the average man' adds fuel to the fire

Mid-late 1800s: Lister uses statistical arguments and Pasteur's germ theory to revolutionise surgery with carbolic spray

Health evidence journey

Circa 1900: Galton, Pearson, Edgeworth and Yule establish Statistics as a discipline



Early/mid 1900s: Fisher advances statistical method and experimental philosophy as Greenwood and Bradford-Hill push Statistics into medical research

Mid-late 1900s: Cochrane pushes for the routine application of randomised clinical trials and leaves the evidence based medicine movement in his wake

Evidence limits showing

- Epidemiology has exhausted the big simple causes of ill health
- Many trials have weak external validity
- Public health interventions unstudied

Many patterns of ill health in society remain unexplained via conventional studies

Meanwhile…

- Biology becoming an information science
- E-Science (integration of data, methods and investigators)
- More data, with more structure
- Inductive 'mining' approaches rising
- Triage & brain vs. silicon priorities

Solution?: Health Informatics partnership to build a new biomedical evidence production line

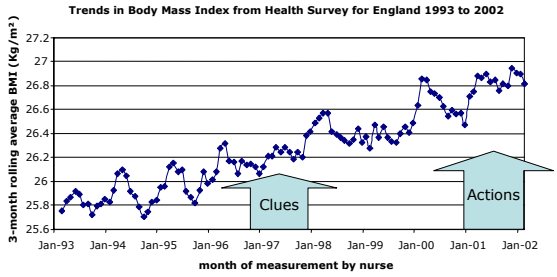
Lets consider the obesity epidemic…

Body Mass Index (BMI)

- Weight for height
- An easy measure of adiposity
- BMI = Weight (Kg) / Height (m^2)
- Not ideal for measuring individual adiposity but good for monitoring change over time in populations.

Quetelet, 1796-1874

Early warning of rising adiposity of English adults



Complex biology

- big mass heart works harder changes of hypertension
- high cholesterol and low HDL:LDL ratio
- insulin resistance
- altered hormone metabolism e.g. oestrogens
- altered liver function
- damaging stresses on joints, ligaments, tendons and muscles
- breathing impairment
- altered intestinal function

- Just starting to understand the interaction of these factors in pathologies such as metabolic syndrome:
  - central obesity + dyslipidaemia + hypertension + diabetes
  - causes early death & strongly predicted by childhood obesity

Personal health impact

- Early death 'from all causes'
  - obesity takes around a decade off your life
    - more if you smoke
    - less if you take regular exercise
- Suffering and disability through:
  - cardiovascular disease
  - diabetes
  - osteoarthritis
  - low self-esteem and social functioning
  - some cancers (colorectal, ovarian, endometrial)
  - liver and intestinal disorders
  - sexual dysfunction
  - sleep apnoea

Population health impact

Estimate for the obesity impact in the Northwest:

Bringing everyone in the **Northwest**

to a body mass index less than 30,

i.e. eliminating obesity,

would result in **7,000 fewer deaths per year**

(95% CI = 2,000 to 14,000)

Extraordinary social problem

Energy balance

in (eating)

out (physical activity)

depends on families, friends, co-workers etc.

can't be isolated and treated in individuals

'passive obesity'

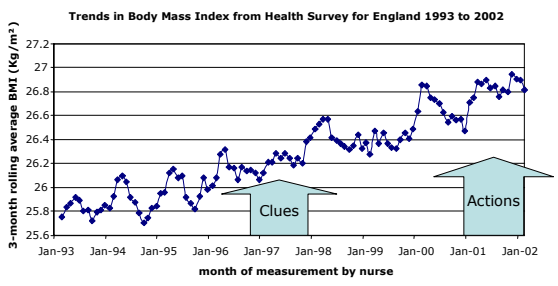
Discovery from e-records

Where are the signals coming from?

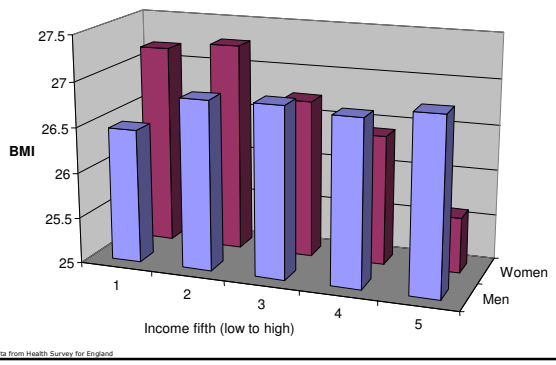
Research archives

Health Survey for England…

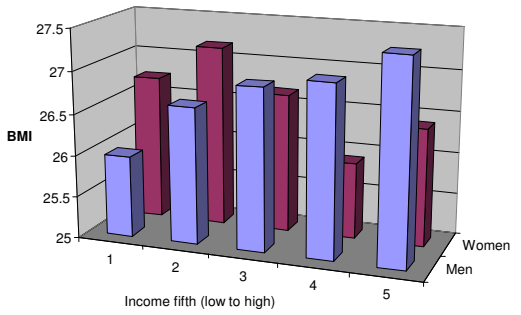
Early warning of rising adiposity of English adults



Women and not men from low-income households are fatter in England



Women from low-income households and men from high-income households are fatter in Greater Manchester



Data from Health Survey for England

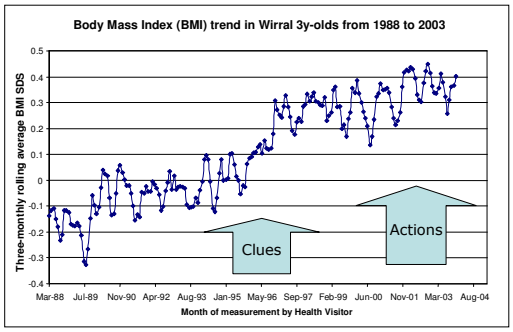
Information utility

- E-records in UK Data Archive
  - But: wait 2+ years after collection
- Large national sample
  - But: only 0.02% of population therefore difficult to study small areas/sub-groups
  - sampling of children not random
- Some objective measurements by nurse
  - But: non-validated questionnaires lead to unexpected results that might reflect response bias more than real trends

Intelligence from routinely-collected but *not* routinely analysed data:

Obesity in Wirral 3-yr-olds, 88 to 03…

Rising fatness of Wirral 3yr olds from 1988 to 2003



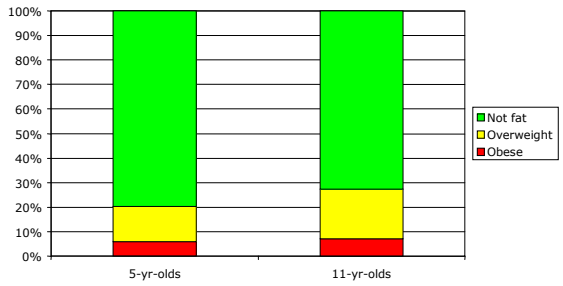
SDS = standard deviation score from 1990 British Growth Reference charts – adjusts for age and sex of the child

Information Utility

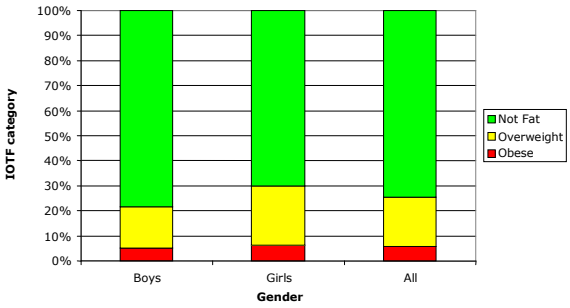
- Large samples
  - Approx. 30-75% coverage of population
- Data quality varies
  - Health visiting and school sources
  - Careful cleaning & interpretation
  - Corroborate findings across localities

There are similar child health data in other localities…

International Obesity Taskforce classification applied to Manchester school children 2000 to 2004

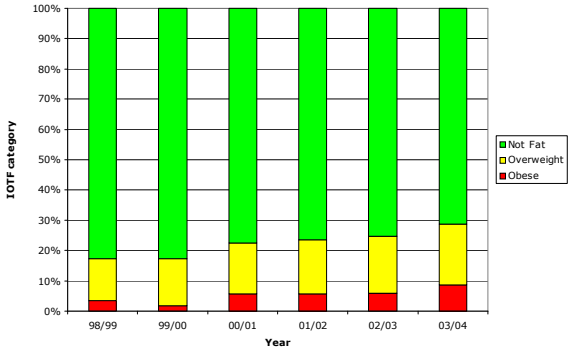


Typical current picture: Rochdale 5yr olds 2005



Girls were 1.55 (95% CI 1.29 to 1.87) times more likely than boys to be overweight or obese

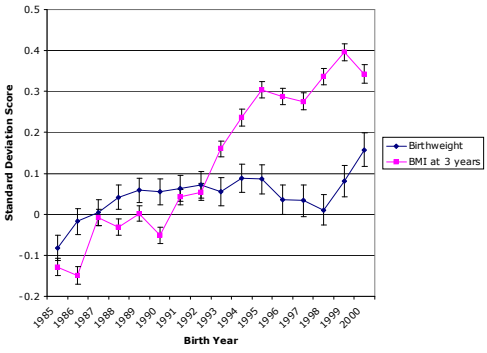
Typical recent trend: Liverpool 10yr olds



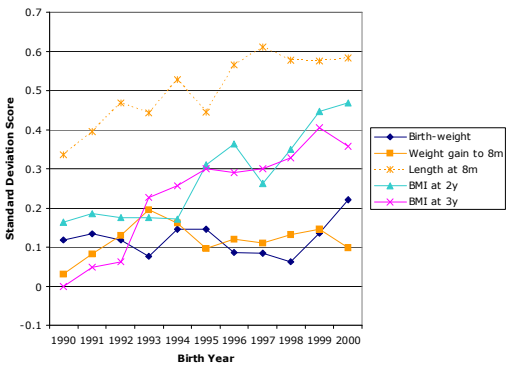
Routine data - stimulating science:

At what age do signs of the obesity epidemic appear?

Birth-weight and BMI at 3 years for children born on Wirral between 1985 and 2000

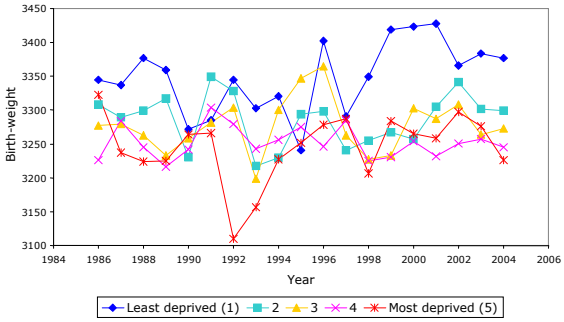


Strongest trends: Rise in BMI at 2 & 3 years and infant length for children born on Wirral between 1990 and 2000

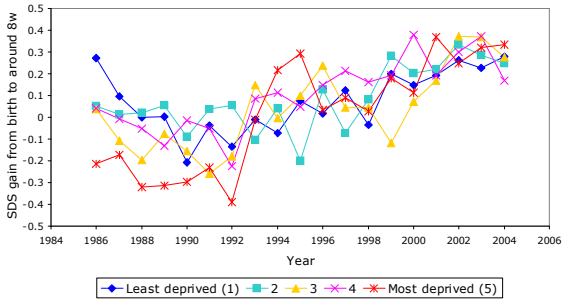


Are some social groups affected more than others?

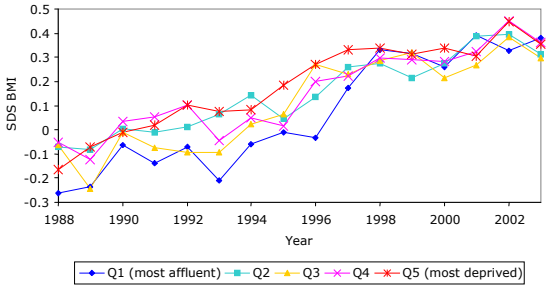
Babies of affluent families are born heavier in Manchester still



Vanishing social trends in early infant weight gain in Manchester from 1986 to 2004

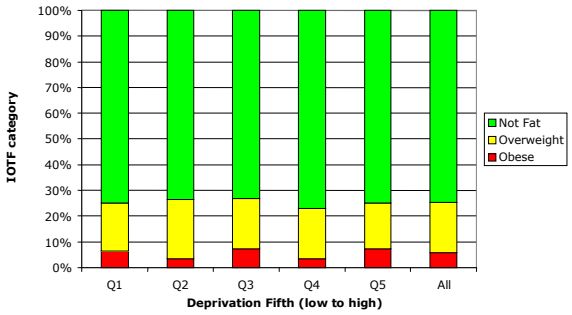


Decreasing inequalities in BMI at 3 years on Wirral



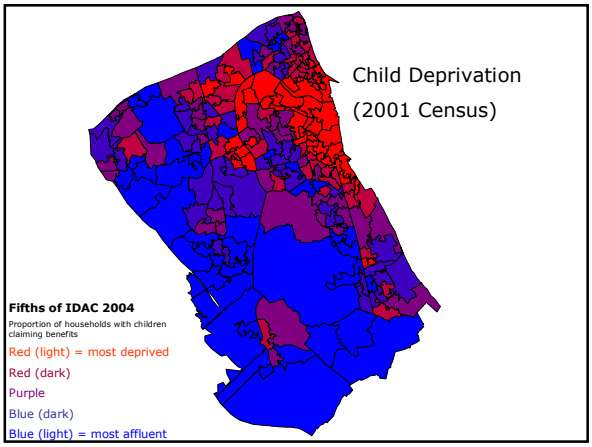
1988-1998: r = 0.039 (95% CI: 0.028 to 0.050)
1998-2003: r = 0.008 (95% CI: -0.008 to 0.024)

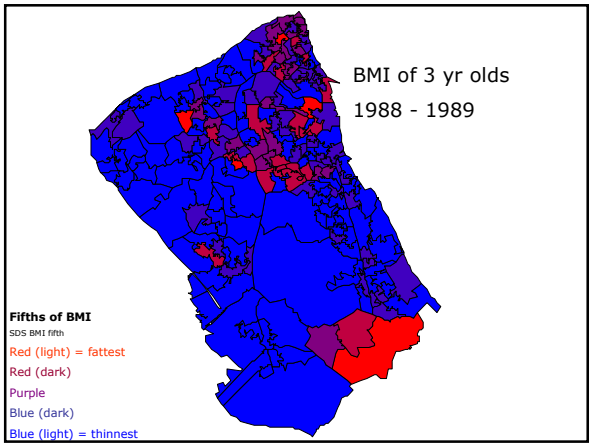
Rochdale 5yr old obesity by deprivation in 2005

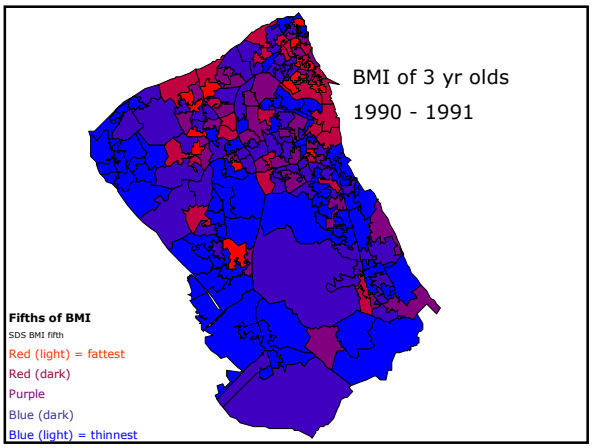


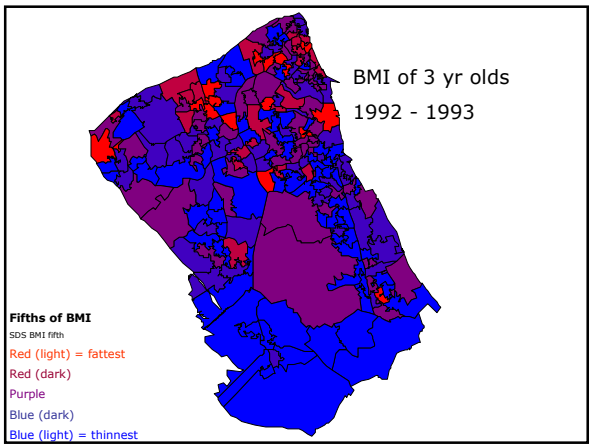
No correlation with deprivation (IDAC 2004): r = -0.04 (-0.08 to 0.05)

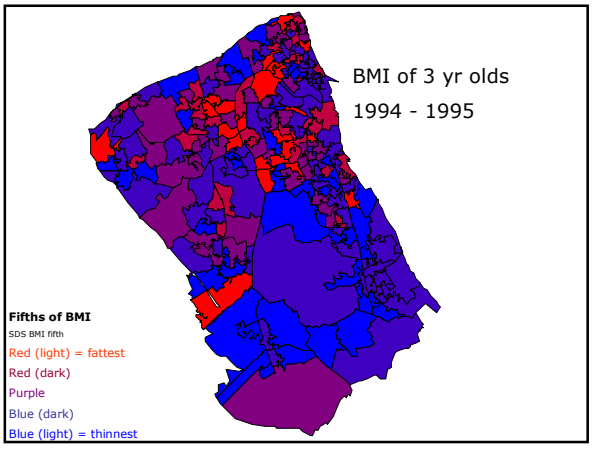
…was there a spatial as well as a social diffusion pattern of obesity across the 1990s?…

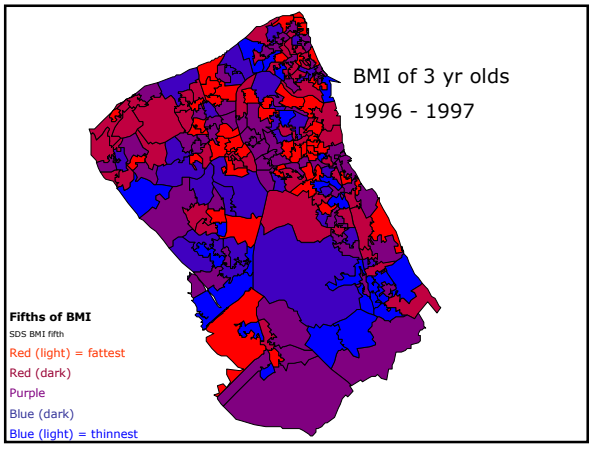

Child Deprivation
(2001 Census)
Fifths of IDAC 2004
Proportion of households with children claiming benefits
Red (light) = most deprived
Red (dark)
Purple
Blue (dark)
Blue (light) = most affluent

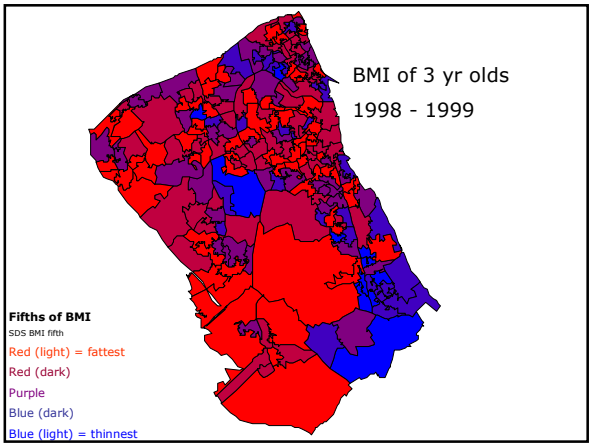

BMI of 3 yr olds
1988 - 1989
Fifths of BMI
SDS BMI fifth
Red (light) = fattest
Red (dark)
Purple
Blue (dark)
Blue (light) = thinnest

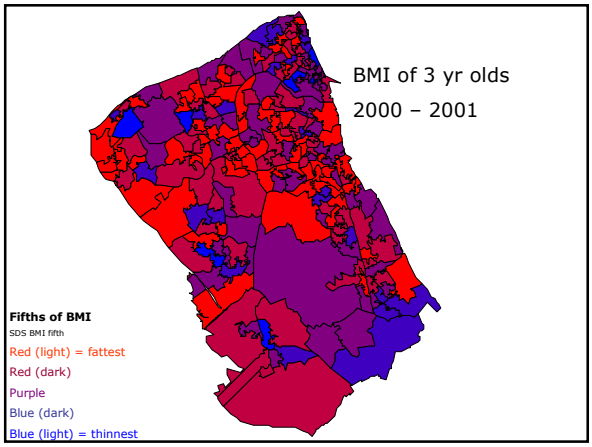

BMI of 3 yr olds
1990 - 1991
Fifths of BMI
SDS BMI fifth
Red (light) = fattest
Red (dark)
Purple
Blue (dark)
Blue (light) = thinnest

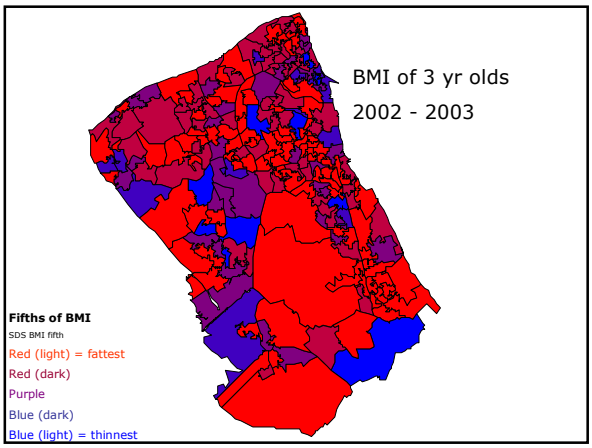

BMI of 3 yr olds
1992 - 1993
Fifths of BMI
SDS BMI fifth
Red (light) = fattest
Red (dark)
Purple
Blue (dark)
Blue (light) = thinnest


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


BMI of 3 yr olds
1996 - 1997
Fifths of BMI
SDS BMI fifth
Red (light) = fattest
Red (dark)
Purple
Blue (dark)
Blue (light) = thinnest

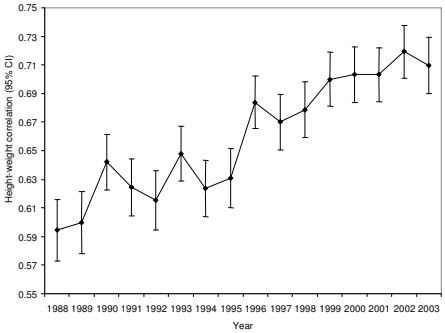






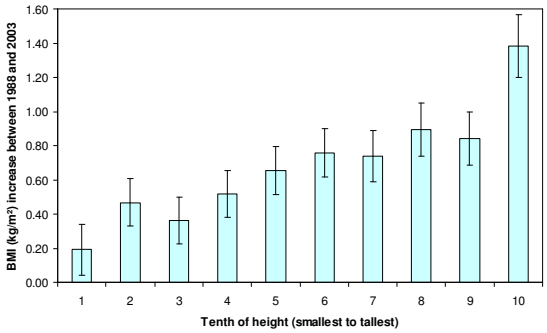
…height and linear growth are socially sensitive,
so how did they change with BMI across the 1990s?…

Increasing correlation between height and weight in Wirral 3-yr-olds 88 to 03 ? Growth effect



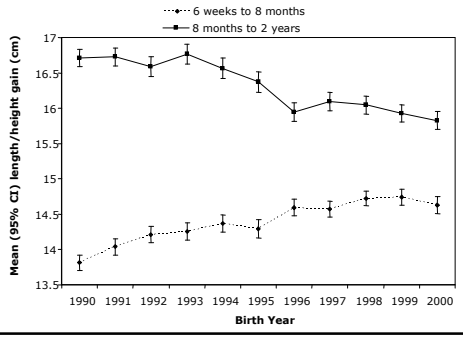
Source: Buchan et al. pre-publication

Secular trend to increasing BMI is much greater in taller children

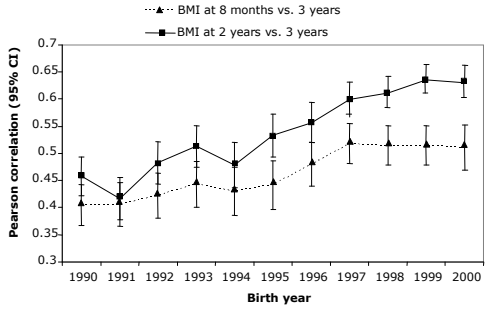


Source: Buchan et al. pre-publication

Faster infant growth and slower early child growth

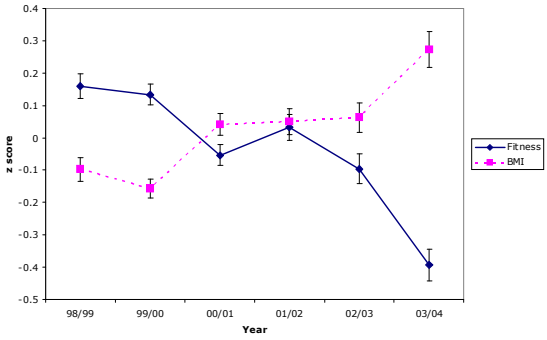


Adiposity fluctuates less in young children than it used to



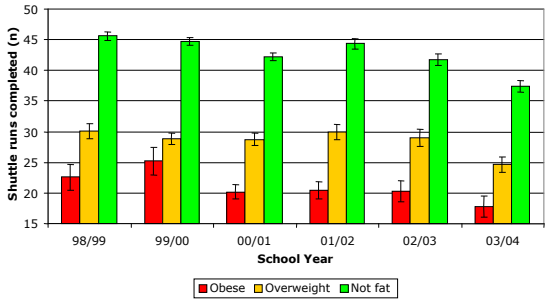
…if fat is sticking more through childhood what is happening to physical fitness?…

Rise in BMI and fall in cardio-respiratory endurance of Liverpool 10 year olds from 1998 to 2004

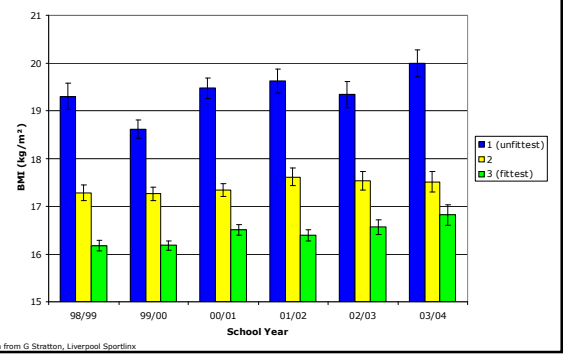


Data from G Stratton, Liverpool Sportlinx

Cardio-respiratory endurance levels of Liverpool 10 year olds fell in all BMI groups



BMI of Liverpool 10 year olds rose irrespective of cardio-respiratory endurance



Data from G Stratton, Liverpool Sportlinx

Discoveries from service e-records

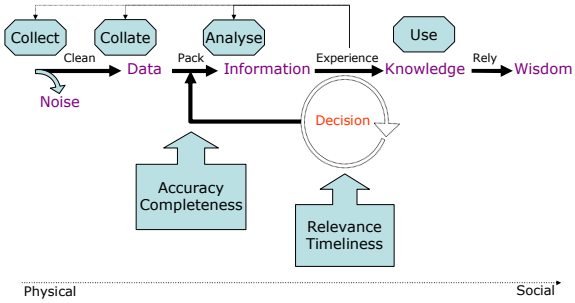
The obesity epidemic in children:

- Concurred with accelerating infant growth
- Showed a temporo-spatial spread pattern
- Ignored socio-economic groups
- Affected the physically fit and unfit alike

Evidence Based Practice
Needs
Practice Based Evidence

Informatics challenges in tackling obesity…

Intelligence to support decisions

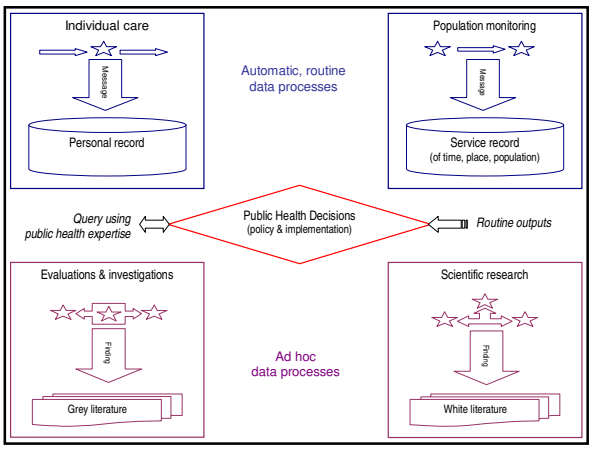


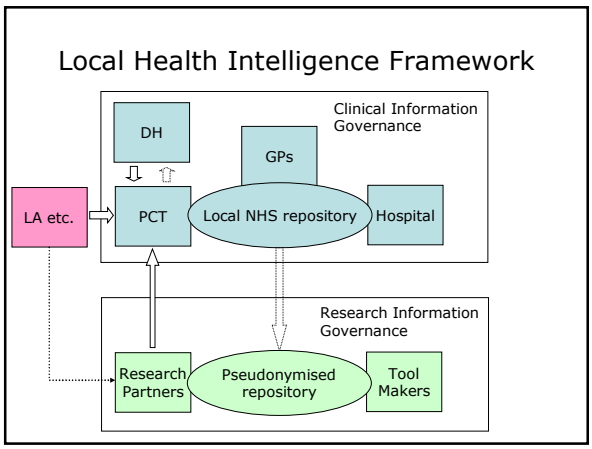
Future decision support

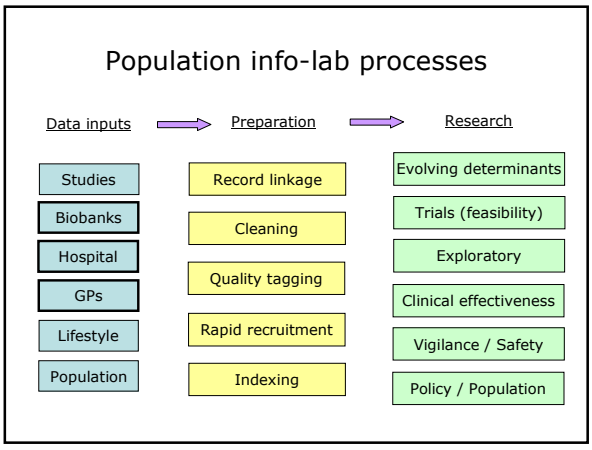
- Personal
  - "*what activities and diet do I need to combat the past 48h of metabolic stress my biosensors report?*"
- Clinical
  - "*what dose adjustment should I make to match my patient's adiposity?*"
- Population
  - "*what is the obesity-related health gain for every pound we invest in green transport?*"

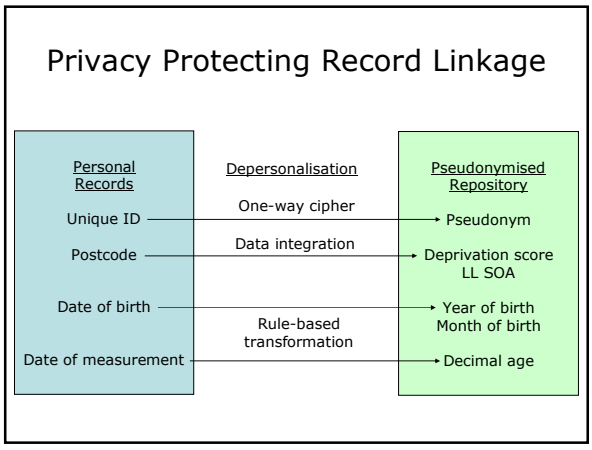
Information culture shifting

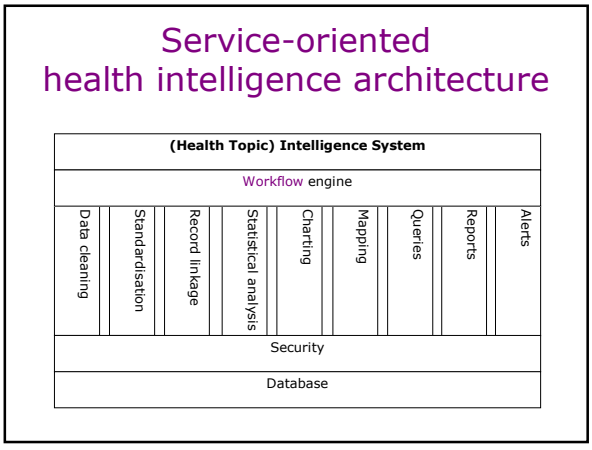
- ↓ Report cycles → ↑ surveillance
- ↑ tactical service responses
- More personal health systems:
  ↑ co-ordination (individual & societal) of preventive healthcare

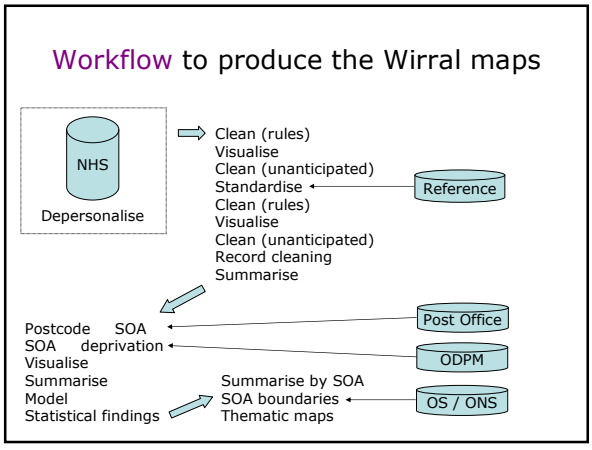

Individual care
Message
Personal record
Automatic, routine
data processes
Population monitoring
Message
Service record
(of time, place, population)
Query using
public health expertise
Public Health Decisions
(policy & implementation)
Routine outputs
Evaluations & investigations
Finding
Grey literature
Ad hoc
data processes
Scientific research
Finding
White literature


Local Health Intelligence Framework
Clinical Information
Governance
DH
GPs
LA etc.
PCT
Local NHS repository
Hospital
Research Information
Governance
Research
Partners
Pseudonymised
repository
Tool
Makers


Population info-lab processes
Data inputs
Preparation
Research
Studies
Biobanks
Hospital
GPs
Lifestyle
Population
Record linkage
Cleaning
Quality tagging
Rapid recruitment
Indexing
Evolving determinants
Trials (feasibility)
Exploratory
Clinical effectiveness
Vigilance / Safety
Policy / Population


Privacy Protecting Record Linkage
Personal
Records
Depersonalisation
Pseudonymised
Repository
Unique ID
One-way cipher
Pseudonym
Postcode
Data integration
Deprivation score
LL SOA
Date of birth
Year of birth
Month of birth
Rule-based
transformation
Date of measurement
Decimal age


Service-oriented
health intelligence architecture
(Health Topic) Intelligence System
Workflow engine
Data cleaning
Standardisation
Record linkage
Statistical analysis
Charting
Mapping
Queries
Reports
Alerts
Security
Database


Workflow to produce the Wirral maps
NHS
Depersonalise
Clean (rules)
Visualise
Clean (unanticipated)
Standardise
Reference
Clean (rules)
Visualise
Clean (unanticipated)
Record cleaning
Summarise
Postcode SOA
Post Office
SOA deprivation
ODPM
Visualise
Summarise
Model
Statistical findings
Summarise by SOA
SOA boundaries
Thematic maps
OS / ONS

NIBHI

… Turning bio-health information into discoveries

M.C. Escher
Order and Chaos, 1950