“Augmenting Human Intellect”
Present and Future of Healthcare ICT

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NHS consultant
HP’s “health insider”
Agenda

Introductions
“Augmenting human intellect”
Hypothesis
Relevance of non-UK examples
Information and medicine: stages and solutions
Defragmentation
About me

HPs “health insider”:
Consultant since 1995; see patients 1 day / week
Integrated care

MBA: clinical management
3y clinical director, 12y medical director, NCAT 2008-12
NPfIT 2006-8, LPfIT, HP ITO / partner

HP Secondment: Voice of healthcare professionals / managers at heart of HP thinking. *Impact on UK healthcare*
Introduction

“There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization(sic) extends. The investigator is staggered by the findings and conclusions of thousands of other workers…truly significant attainments become lost in the mass of the inconsequential…”

Vannevar Bush “As we may think” 1945

NEW YORK | Tue Sep 10, 2013 5:43pm EDT
(Reuters) - Cancer treatment has grown so complex, many U.S. doctors can't keep up with new information and are offering incorrect treatment, failing to explain options and leaving patients to coordinate their own care, according to a report released on Tuesday by the Institute of Medicine, part of the National Academy of Sciences.
“Big Data”

Datasets whose size and complexity put them beyond the power of conventional analytical methods

3 “V”s (Forrester)
- Volume
- Velocity
- Variety

PubMed, 5y
- 3500 studies hospital readmission
- 10,000 comparative effectiveness
- 40,000 drug-drug interaction
- 130,000 hospital morbidity

Big data analytics: techniques and technologies that make handling data at extreme scale affordable
Augmenting Human Intellect (Douglas C Engelbart, 1962)

“Increasing the capability of a [person] to approach a complex problem situation, to gain comprehension to suit [their] particular needs, and to derive solutions to problems”.

2 levels

Level 1:
- Faster
- Better

AND...

Level 2:
- Useful degree of comprehension in situation previously too complex
- Finding solutions to previously insoluble problems

“We refer to a way of life in an integrated domain where hunches, cut-and-try, intangibles, and the human "feel for a situation" usefully coexist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids”
Hypothesis: Healthcare ICT

We know what is needed.
We know how to do it
   The solutions are already deployed across the world
The decision-maker is changing
   We need to “defragment” the solutions on offer
Relevance of cases outside the UK

Convergence across the developed world

We all follow the same evidence base
We all have the same problems
We are all adopting similar solutions
Medicine is about information

- Doubling time of medical information is around 10 years
- Even specialists have trouble keeping up (right now)
- The half life of leading edge medical knowledge is 5-6 years
- 90% data unstructured / semi-structured / complex
- Social / environmental causation is highly complex

AND...

ICT and related fields are also growing exponentially, with rapid doubling times, and half lives of 2-3 years for knowledge.
The Pyramid of wisdom: information processing model

- **Data**
- **Information**
- **Experience, interpretation**
- **Knowledge**
- **Study, Learning**
- **Wisdom**

**Process stages:**
- **React**
- **Sense and respond**
- **Cause / Effect**
- **Predict**

**Decision-making strategies:**
- **Proactive, preventative decision-making**
- **Reactive, corrective intervention**
ICT: “Augmenting Human Intellect”

- Wisdom
- Study, Learning
  - Knowledge
  - Experience, interpretation
  - Information
- Organise, Process
  - Data

Fragmented, partial, historical, \(\rightarrow\) comprehensive, coherent, real-time,

- React
- Correlation \(\Rightarrow\) Cause/Effec
- Predict
- Expert systems and decision support
- Analytics and “meaning-based computing”
- Sense and respond
- Automate analysis, sort, correlate, display
ICT: Building blocks

- **Wisdom**
- **Knowledge**
- **Information**
- **Data**

**Knowledge management and decision support**

**Clinical analytics, intelligent dashboard**

**EPR, Business information systems, “paperless”**

**Data collection / integration**: “Integrated care” mobile, remote.

**Digital Infrastructure**: tin, string, process; Business engagement; people

- **React**
- **Sense and respond**
- **Correlation**
- **Predict**
Worked examples
ICT: Augmenting human intellect: level 1

- Wisdom
- Knowledge
- Information
- Data

Digital Infrastructure: tin, string, process; Business engagement; people

World Class Infrastructure & Total Integration of IT, Comms & Devices

St Olav, Akerhus hospitals (Norway)

**Goal:**
- Integrated technology/information supporting patient journey/experience
- Transformed efficiency and patient outcomes
- Outcomes (2y):
  - +30% Outpatient capacity,
  - -20% Length of Stay,
  - +5.5-6% YoY productivity improvement

“St Olav hospital… should be considered the world’s benchmark in terms of tactical and strategic usage of technology in life and death scenarios…” – IDC Case Study

St. Olav University Hospital

HP Health Center of Excellence (HCOE) - www.hp.no/hcoe

Cambridge University Hospital Trust

**CUH eHospital objectives:**
- World class new EPR
- All practical technology solutions to improve patient outcomes & efficiency
- Comprehensive data collection, decision & research support is key

THEMES

- Patient experience: quiet, therapeutic, informed
- Staff experience: easy to get it done
- Efficiency gains

Royal Adelaide Hospital

- Complete integration of Data
- Technology
- Communications
- KPMG estimate 21% total savings

Patient Journey

Safe Care

Healing Environment

Treat the Whole Patient

Efficiency & Effectiveness

Future Workforce
Improving data collection

Belfast Social Care Trust (HSC) / Ireland HSE

Health / Social care
• Mobile data collection and monitoring solutions
• Highly secure

Foundation Paraguaya

- Interactive, immersive experience.
- Point of contact data gathering
- Visual data input → graphical surveys
- Automated analysis

Order of magnitude change in time taken to conduct and analyse survey information

Online/offline

Data input (visual display, comprehension)

Automated analysis and feedback

THEMES:

Security (device / transmission / storage)

Online/offline data collection on laptop or mobile device

Photo capture to associate with survey
## Telehealth

### Ontario telehealth network
- >1000 sites; > 3000 clinicians, >50 specialties,
- 6 tele-emergency services, 24/7 accessibility
- >100,000 clinical events
- 91% increase in activity in recent years
- >800 patients COPD Home telehealth
- Telehomecare
- 97% patient satisfaction
- Remote mentoring, training
- Diffusion of best practice
- OTN Proprietary software for service management

### Veterans’ Health Administration
- > 80,000 patients treated, > 500 sites
- Improve clinical outcomes
- Reduced visits: Emergency, routine
- 86% patient satisfaction score
- 24% Reduction in occupied bed days
- Virtual training of staff
ICT: Augmenting human intellect: level 1

- Wisdom
- Knowledge
- Information
- Data
- React
- Sense and respond
- Correlation \(\Rightarrow\) Cause/Effect
- Predict

EPR, Business information systems, “paperless”
Paperless, Filmless, Wireless Hospitals,

Costa Del Sol Hospital, Baleares Inca & Menorca Hospitals

Inca Hospital:

Small DGH. Small IT dept.
HP EPR & Workflow suite (HCIS)
Integration with other information subsystems (RIS / PACS, LIS, etc.) and EDM
Full integration clinical & management information
Integration with external systems

Benefits:

HIMMS level 6
Paperless >5y
  PoC, paperless patient data entry, retrieval
  full e-prescribing

Patient-level costing
# HCIS: benefits

| Clinician  | Clinical forms and pathways: (many derived from English)  
|           | Easily user-configured  
|           | Point-of-care orientation (role-specific workscreens)  |
| Organisation | Easy-to-use reporting tools (incl patient-based costing)  
|           | Accommodates “best of breed” approaches, legacy system integration  |
| System    | Acute, MH, community, primary care capability  
|           | Integration engine at core: supports whole-system working  
|           | Web-based; Rebuilt (Java) for mobility  |

120 (+7) deployments. ... highly competitive EPR, extremely flexible, lot of potential.
HCIS Scope

- Primary Care
- Home care
- Nursing Home
- Community & Mental Health Centers
- Hospital
  - Inpatients
  - Day Cases
  - A&E
  - Outpatients
- Other Care Providers:
  - Public health
  - Social care
- Referrals
- Patients
Emergency Room (ER) Admission

Billing department

Chief of Paediatrics department

Chief of Emergency Room

Quality Assurance

Preventive Medicine department

Process automation / conditional logic: example

ER arrival

Review billing details (task)

Patient of certain insurance company

Patient < 3 y.o.

Inform chief of paediatrics dpt. Patient less than 3 y.o.

If patient has been in ER in last 72h

HCIS alert

Inform chief of ER dpt. of situation

If admission due to accident

Register additional accident details (task)

If infectious patient last year

Patient-Risk Monitoring (task)

HCIS alert
HCIS screenshots
ICT: Augmenting human intellect: level 2
“Getting ahead of the pathologist”

Wisdom

Knowledge management and decision support

Predict

Knowledge

Correlation ⇒ Cause/Effect

Clinical analytics, dashboards

Sense and respond

Information

Enterprise Content Management

React

Data

“Some data” ⇒ “All data”
Situational Awareness: EPR analytics-enabled checklists

Lucille Packard Children’s hospital at Stanford

- Clinical decision support, in pediatric ICU
- Unit-wide overview
- Detailed risk indicators for each patient
- Fully integrated with EPR
- Compliant with evidence-based guidelines

Impact on patient care: Use of the Dashboard prompted change in care in 1/3 of patient rounds

Better clinical care:
- Less frequent investigations
- Earlier transition of IV to oral medications
- Removing central lines
- Adjusting sedation
- Positioning to prevent pneumonia

http://www.youtube.com/watch?v=VVZPbhclAM
HP Healthcare Analytics platform overview

HP IDOL + Healthcare Taxonomies Medical Codings Clinical Classifiers + Healthcare Visualisations Medical Workflow UI

1000+ types of file

EPR Lab Results Pharmacy ADT Commissioner RIS/PACS PBC Documents

Search Knowledge Discovery Hypothesis Generation HAI Detection Compliance Reporting Predictive Analytics Best Practice + Patient Experiences

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HP Healthcare Analytics platform
Built for unstructured and structured clinical data

Core capabilities:
- Integrated modular platform for variety of use cases
- 150+ health data types
- Rapid identification of concepts, patterns and relationships
- Conceptual search on all data
- Advanced security

Healthcare specific capabilities:
- SNOMED CT taxonomy with 344K+ concepts and 2M terms
- Integrated ICD codes
- Intuitive workflow UI and visualisation for healthcare applications

Intelligent search and actionable insights powered by HP IDOL (Intelligent Data Operating Layer)

“order from chaos”
Interfaces:
Wide range of healthcare use cases ...

All levels of data aggregation

Reconciliation

Reporting

Thematic review

ID discrepancies between diagnostic code and clinical notes

Monitor KPIs and Metrics

Rapid Notes Access
ECM (Enterprise Content Management) without Borders

Productivity improvement through access and control, everywhere, anytime

Single platform pulling all forms of data into 1 place.

- **TeleForm**: intelligent document recognition and classification.
- **(Business) Process Automation** using 100% data.
- **WorkSite** document and email management.
- + **Universal Search for WorkSite**: meaning based enterprise search. (all languages, devices, etc.)
- **HP Records Manager (RM) and ControlPoint** - manage and apply policies to stored information.
Defragmentation
Would you buy a car starting from this list?

Car Parts

- Air Conditioning & Heating (93,869)
- Air Intake & Fuel Delivery (329,936)
- Braking (950,635)
- Electrical Components (172,163)
- Emission Systems (40,068)
- Engine Cooling (162,725)
- Engines & Engine Parts (446,362)
- Exahusts & Exhaust Parts (112,581)
- External & Body Parts (129,277)
- External Lights & Indicators (504,194)
- Gauges, Dials & Instruments (3,718)
- Ignition (168,627)
- Interior Parts & Furnishings (241,856)
- Service Kits (57,648)
- Suspension & Steering (599,816)
- Transmission & Drivetrain (179,641)
- Turbos & Superchargers (5,331)
- Windscreen Wipers & Washers (167,545)
- Other Car Parts (278,099)

(Source, Ebay)
Would you buy a car like this?

Kit Car…
That’s more like it…

Sharan SEL

Each car model has a range of engines, how much power do you want?

Choose from 5 engines for your Sharan SEL

Filter by fuel type:

Filter by gearbox type:

Filter by efficiency type:

Total cost: £31,590
The New Purchasers of ICT

No longer the IT department / director

- They (probably) understand most of what suppliers say

C-level directors:

- very short of time
- 25+ years too old to be digital natives
- Very little knowledge of ICT. Know they need to use it.
- Familiar with consumer IT: “why can’t it be like this at work?”
- Nervous about innovation
- Fearful of “failure”

Move from selling components, to (pre-)integrated solutions

(coULD WE HAVE “cloud” showrooms of integrated health solutions?)
It doesn't need massive consolidation…

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Suppliers</td>
<td>200</td>
</tr>
<tr>
<td>Number of the Components</td>
<td>About 2 Billion Units</td>
</tr>
<tr>
<td>Purchased Monthly</td>
<td>150 Thousand Kinds</td>
</tr>
<tr>
<td>Values of Purchased Component</td>
<td>300 Million Dollars a Month</td>
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<table>
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<th>Distribution of Suppliers</th>
<th>Domestic</th>
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<tbody>
<tr>
<td></td>
<td>Toyota District</td>
<td>119</td>
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<td>Tokyo District</td>
<td>66</td>
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<td></td>
<td>Osaka District</td>
<td>25</td>
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<td></td>
<td>Overseas</td>
<td>U.S., Canada, France, U.K.</td>
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<td></td>
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<td>Sweden etc.</td>
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Future Visions

NorfolkNext: Our Journey together...

Total integration of public services around the citizen
Multiple partners, global and local
Creation of local training and employment
“sick care” $\Rightarrow$ wellness

“HP could demonstrate strong capability and solutions to support its claims, which is why it was selected” Ovum
Conclusions

ICT already in full scale deployment is capable of transforming healthcare
We have to improve the delivery models

QED
THE END

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## HCIS evolution

<table>
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<tr>
<th>HP-HIS.1</th>
<th>HP-HIS.2</th>
<th>HP-HCIS</th>
<th>HP-HCIS</th>
<th>HP-HCIS</th>
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<tr>
<th>Scope</th>
<th>A single Hospital</th>
<th>A single Hospital</th>
<th>A complete Care Delivery Organisation</th>
<th>Home care and telemedicine</th>
<th>Healthcare Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
<td>Administrative Functions (ADT system, scheduling &amp; appointment…)</td>
<td>+ EPR, Orders &amp; Results, Nursing Care Plans</td>
<td>+ e-prescribing, GP support, clinical pathways (basic)</td>
<td>Clinical decision support, clinical pathways &amp; enhanced workflow</td>
<td>Mobile Health and Wellness</td>
</tr>
<tr>
<td>Technology</td>
<td>Dumb terminals, UNIX servers</td>
<td>Client-server, 2-tier, GUI</td>
<td>Web-based, J2EE, N-tier</td>
<td>SOA Cloud/SaaS</td>
<td>Open Source Any Device</td>
</tr>
</tbody>
</table>

127 References in Spain

- +South America
- +India and Portugal

+Global HCIS
HP HCIS Architecture

HCIS Modules

Portal

Inpatients
Outpatients
Day Cases
A&E
Theatres
Clinics & Homes
Primary Care

Billing/Patient Based Costing
PAS
Requests & Results/Order Comms
Medication Management
Nursing/Care Plans
EPR/Clinical Docs/Notes and Clinical Workstation
Reporting & BI
HCIS Configuration Toolkit
Terminology (ICD-10 & OPCS-4)
Security

Workflow

Care Settings

HCIS Modules

HL7

LIS
RIS/PACS
Pharmacy
Pathology
...
HR
ERP
Legacy HIS

Note
“best of breed” approach to specialist systems.
Ease of integration with legacy / departmental systems.
HP Healthcare Analytics platform overview N1

HP IDOL +

Healthcare Taxonomies
Medical Codings
Clinical Classifiers

Healthcare Visualisations
Medical Workflow UI

Search | Knowledge Discovery | Hypothesis Generation | HAI Detection | Compliance Reporting | Predictive Analytics | Best Practice + Patient Experiences

400+ connectors

Patient Communications | Medical Guidelines | Provider Collaborations | Clinical Narratives | Medical Literature | Transactional Data | Schedules | IT/OT | Web

EPR | Lab Results | Pharmacy | ADT | Commissioner | RIS/PACS | PBC | Documents
About HCIS

Exceptionally close direct working with customers
Exceptional customer control

Total health system coverage
Very high levels of local ownership and autonomy
  - local ownership of configuration
Shared development and customer oversight
Bundled clinical functionality

Critical success factor: close engagement with customer
Mobile Electronic Patient Record system

- HP Healthcare Information System (HCIS) new mobile version
- Rollout in Spanish hospitals installed base starting in 2014