The Third Industrial Revolution - the practical application of digital technology in an NHS hospital.
The brink of a 3rd IR driven by electronic communication

- Steam, Petrol & Electronic.
- Medical technology incrementally advancing.
- Digital technology is providing the disruptive change for transformative change.
- Potentially offers a route to balance supply & demand.

Jeremy Rifkin 2011
Main Components of the Digital Revolution in Medicine

- **Big Data**
  - Healthcare Data
  - Public Data
  - Self Generated Data
  - Biometric Data
  - Bio-informatics

ABPI Big Data Roadmap

Delivering the best in care
Healthcare Data

- Health Episodes Statistics
- Electronic Patient Records
- Research Trial Databases
- Phenotype data
- Stratified Patient Cohorts
- Primary Care Data
- Care 4 Data
- Physiological Measurement Data

Big data could dramatically cut £80bn NHS chronic care bill
Technology will sit at the heart of the health service’s efficiency drive and its shift to using data to deliver services predictively

John Burnett
Guardian Professional
Bio-informatics

• The DNA revolution has transformed our understanding of the molecular basis of human disease
• As a result of the investment of billions of dollars has given us the tools to transform the management of human disease
• Novel diagnostics, therapeutics and devices now represent multi billion pound businesses and a huge opportunity for UK PLC
• The major challenge for patients and the life sciences industry is how to translate scientific advances into clinical practice as swiftly as possible
Bio-metric Data

- Home monitoring
- Wearable devices recording cardiac output.
- Re-engineering technology eg Kinetic
- Bluetooth technology
Self Generated Data

- Social Media
- Patient Feedback Apps
- NHS Choices
- Crowd Sourcing
- 3rd Sector Data
Public Data

• Integrated data packages including Crime, Social Care and Deprivation.
• Office of National Statistics Data.
• Health Economics Evaluations
• Public Health Data
Our Vision: To deliver the best in care
Use of Clinical Technology and IT.

- QEHB – most modern hospital in UK.
- Biggest Diagnostic procurement ever in the UK (£21m] 6 MRI’s and 6 CT’s.
- PET Scanner
- Tomotherapy and 8 linacs.
- Automated Laboratories.
- Most sophisticated Clinical Decision Support System developed in the UK incorporating e-prescribing, e-Obs, e-alert (SEWS), e-assesment.
UHBFT Embeds IT in its Strategy

To deliver the highest levels of quality evidenced by technology, information, and benchmarking.

To ensure UHB is a leader of research and innovation.

To listen to what patients want and respond quickly and proactively.

To create a fit for purpose workforce for today and tomorrow.

To deliver best in quality outcomes and efficiency.

Delivering the best in care.

- Technology, Information, and Benchmarking
- Clinical Quality
- Research & Innovation
- Patient Experience
- Education & Training
- IMPROVED COMMUNICATION
- Cross-Organisational Partnerships
- Capacity and Capability
- Effective Workforce Management
- Learning and Development Programmes and Career Opportunities
- Status as a Teaching Hospital
- Capacity and Capability for Innovation
- Commercialisation of Trust Services
- Strengthen Research Base
- Applied Learning and Evidence-based Best Practice
- Latest Available Technology
UHBFT approach to Quality – what to measure?

- Huge scrutiny of Hospital performance.
  - Hospital mortality is circa 3%.
  - Evidence is that 5% of hospital deaths are potentially preventable.

- Monitoring Hospital mortality is looking for a 0.15% difference (5% of 3%) between best and worst.

- Hospital mortality is a link in the chain.
  - Pre hospital care.
  - Post hospital care; including the quality of community care and hospice provision.
Different views

• Local BMW engine factory
• 99.9% perfect leaving plant
  – Should be 100
• Real interest
  – % trouble free at 5 years
• Bolts on engine head line up
  – Different take on errors
Error Management Strategy

• Aim - to reduce errors to a minimum.
• System – Real time clinical data.
• Process – Making the information available in a usable format.
• People – hold to account across the whole Trust.
System - UHB “filter”
Prescribing Information and Communication System [PICS]

• Clinical Decision Support System
  – Prevents errors at point of decision
  – Allows analysis and rectification of systematic problems
  – Provides clear audit trail

• Manages all inpatient
  – Drug prescribing and administration
  – Laboratory requests and results
  – Imaging requests
  – Obs & More
PICS at UHBFT

- Nearly 4,000 users
- Hand held tablet PCs (600) mobile computers (100) and desktops (4000)
- 23,767 prescriptions per week
- 118,168 administrations per week
- 146,000 potential errors prevented by system P/A
- Significant variation between junior doctors
In prescribing terms -

From this

using these

to this
### PICS Drug Administration Chart

<table>
<thead>
<tr>
<th>Drug</th>
<th>01.02</th>
<th>02.02</th>
<th>03.02</th>
<th>04.02</th>
<th>05.02</th>
<th>06.02</th>
<th>07.02</th>
<th>08.02</th>
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<tbody>
<tr>
<td>Atracurium</td>
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<td></td>
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<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Chloramphenicol</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Escomeprazole</td>
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<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Folic Acid</td>
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<td>✓</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Furosemide</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Ganciclovir</td>
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<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hydrocortisone Sodium Succinate</td>
<td>✓</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hypromellose Eye Drops</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
<td>Meropenem</td>
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<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>Metoclopramide</td>
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<td></td>
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<td>✓</td>
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<tr>
<td>Metronidazole</td>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Oxygen (Face Mask)</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Piperacillin / Tazobactam</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Ranitidine</td>
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<td>✓</td>
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<tr>
<td>Saline Nebuliser</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>Vancomycin Oral</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
PICS provides the data platform for advanced informatics

- Real-time missed dose reports
- Complex indicators of precision of therapy
  - 340 indicators currently
- Real-time infection control information
- Live bed state viewer

• Over 10 years in development
- £25m development costs
- No Business Case or Project Plan
- Provides the disruptive technology to facilitate change
Electronic Alerts

- Observations recorded on PICS.
- SEWS algorithm to patients in difficulty.
- Automated hierarchical message alert on PICS.
- Red status – automatic alert to ITU outreach team.
World First Computer generated prescription?

- MRSA testing.
- Positive lab result triggers automated prescription.
- Eradication therapy administered.
- Process time to prescribe reduced from average 48hrs to 10 seconds.
Electronic Data Capture in OPD

- Consultation workflow
- Co-Morbidities (Quick Pick)
- Drug History & Prescribing
- Clinical Noting
- Clinical Observations
- Concept of face-to-face or non face-to-face consultation
- Integrated digital pen
- Integrated with WinScribe
Facilitates a Journey from this -
To this.....
Process – Making the information available in a usable format.
People – held to account across the whole Trust.
CEO RCA meetings

- Initially missed doses
  - patients with 2 or more missed doses of antibiotics while WCC high
- Executive Team questions clinical teams with electronic record displayed
- New queries monthly
- Significant improvement in targeted areas
How do we compare

- All England data reporting
- Hospital Episode Statistics linked to Office of National Statistics death certification.
- CUSUM alert triggers – CQC
- Efficiency reporting, avlos, DNAs etc
- 170 US Honour Role Hospitals Outcome data, Italy and Australia
Partners with our patients

- Adding value to the patient by accessing their health records remotely.
- Maximise effectiveness of consultations.
- Informed patients.
- Real example of co-production in action
External Comparators
Omitted doses: Non antibiotics

Percentage

Apr-10 | Jun-10 | Aug-10 | Oct-10 | Dec-10 | Feb-11
---|---|---|---|---|---
UHB (PICs) | System A | System B

Delivering the best in care
Change Prescribing Behaviour

- Propofol
- Midazolam
- Both

- £0.50
- £1.00
- £1.50
- £2.00
- £2.50

pre
post
Enforce Policies

Oral antibiotic prescriptions with duration greater than 5 days

Before duration restricted to 5 days
After duration restricted to 5 days

Days
Reduce Errors

Relative proportion of medication errors

Administration: National (60), UHB (30)
Dispensing: National (30), UHB (10)
Prescribing: National (20), UHB (5)
Monitoring: National (10), UHB (10)

Delivering the best in care
Improve Efficiency

Protocol implementation

Number of lab requests per patient

UHB Mortality Reduction

Deaths / 1000 discharges

- UHB
- England no UHB
- England

Mar-08, Jun-08, Sep-08, Dec-08, Mar-09, Jun-09, Sep-09, Dec-09, Mar-10, Jun-10, Sep-10, Dec-10
Big Data Potential

Clinical Informatics: Digitally enabled Trusts generating in-depth bio-clinical data
- rules based clinical decision-making system operates throughout UHB
- Planned roll-out to BCH commences 2013/14

Health Informatics:
- Clinical Quality Informatics & Display
- Healthcare Evaluation Data Business Support system – nationally provided: (uses HES)

Bioinformatics:
- Genotyping: high density datasets derived from transcriptional profiling or next generation sequencing
- Phenotyping; deep immuno-phenotyping of blood and tissue
- Metabolomics & Proteomics
- Spectroscopy
- Biomarkers
Next generation disruption

• 100k genome
• Precision medicine
• Evidence based platforms to provide binary decisions
• Reduced specialisation and increased generic applications
Big Data Challenges

• Disruptive Technology comes at a price.
• Tells you things you may not want to know.
• Traditional Business Models are not fit for purpose.
• Education
• Potential for abuse.
• Big data becomes an end not a means.
“We know what happens to people who stay in the middle of the road. They get run down.”

Aneurin Bevan