Innovation in healthcare: Key challenges and opportunities

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A view of innovation in healthcare

Where do we want to innovate?

Policy

Here? More agile policy to meet changing needs?

Services

Here? Better services – for patients and a better environment for providers?

Systems

Drugs, technology & infrastructure

Here? Better infrastructure, networks, logistics and technology?

Basic science
It's a funny old world

Innovation in healthcare

Policy

Services

Systems

Drugs, technology & infrastructure

Basic science

One thing

(Largely) public

Decades

Funding

Change takes...

Years

The other

Private

Easy

Impossible

IP Protection
A major problem

Policy

Services

Systems

Drugs, technology & infrastructure

Basic science

Invention

Improvement

Service delivery

Dysfunctional interaction

Technology

The future
Simple questions:

- Measures of performance (is it getting better or worse?)
- Tools and methods for comparing new approaches
- Formal ways to try them out

What do you need to make a cycle work?

- Measures of performance that both communities understand
- Comparative measures of performance (what if X gets better but Y gets worse?)
- Tools for synchronising improvements.

How about a pair of coupled cycles?
What progress have we made?

Service improvement

Simulation & modelling

Users

Invention of new technologies

Business planning
MATCH: Research ‘below the interface’

Birmingham, Brunel, Nottingham, Ulster - £12.5M EPSRC grants over 10 years (including £500k from DTI and £1M from DH)

Economic Evaluation Tool for Early Assessment of Value

Innovation in healthcare

innovation

interface

Connects to new product development cycle

Health economics

Materials

System

Technology

Services

Policy

improvement

invention

Market

Phase 1

Phase 2

Phase 3

Phase 4

Phase 5

Business Plan
Engaging with users...

www.match.ac.uk


Due out shortly
User needs

• Empirical work underway
  – On usability
  – To connect economic evaluation to user needs
  – To illuminate our initial classification
What progress have we made?

Some monitoring is moving from service provision to self management

Service improvement

Invention of new technologies
Innovation in healthcare

Back to the evidence

I believe that...

Phase 1  A  Phase 2  B  Phase 3  C  Phase 4  D  Phase 5

Formalise your guesses

Rev Thomas Bayes (1702-61)

Add in the data as you can

I can prove that...

http://www-groups.dcs.st-and.ac.uk/~history/PictDisplay/Bayes.html
Where does this take us?

Supply side?

Bayesian framework for evidence gathering

Demand side

Early, temporary or conditional routes to market

One-off decision (NICE, reimbursement, licensing?)
A look at pricing and uncertainty

• Problem: If I know that my product will be subject to an HTA review that may include cost-benefit analysis, what should my pricing strategy be?

Innovation in healthcare

(Early-stage)

Now the future

HEM

Product Development

Intermediate Decision Gates

Reimbursement?

Yes

No

Abandon

Abandon

Now

The future

MATCH
An Example

Health-Economic model (with Bayesian inputs) generates a probability distribution for the Maximum Reimbursable Price (here centred on £13,000).

The cost-effectiveness gap (C/E gap) represents the maximum reimbursable price, MRP.

Commercial viability limited by “Break-Even” price… (~£20,000).
Current decision tempered by opportunity to Abandon project at a later stage.

- **Project Abandoned (later)**
- **Potential Profit**

<table>
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<th>72%</th>
<th>28%</th>
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**£20,000**
Break-Even Price
Here, the headline assessment is unfavourable. But there may still be value in the project, captured by the right-hand end of the MRP distribution.

**Estimated Return**

\[(\£31,000 - \£20,000) \times 0.28 \sim \£3,000 \text{ per patient}\]

This must be set against development cost to inform decision to proceed.
Where does this take us?

Supply side

Value-based go-to-market strategies

Investment, pricing and decision-making support

Bayesian framework for evidence gathering

Demand side

One-off decision (NICE, reimbursement, licensing?)

Early, temporary or conditional routes to market
RIGHT: Research above the ‘interface’

- Policy
- Services
- Systems
- Technology
- Materials

Connects to the Darzi Review

Innovation in healthcare

Brunel, Cambridge, Cardiff, Southampton, Ulster - £1.2M EPSRC grant over 2 years

Birth → Childhood → Staying healthy → Long term conditions

Acute episode → Planned care → Mental health → End of life
Above the line – a surprise!

Only 8% of papers from healthcare analyse a real problem with user engagement, (cf 36.5% defense literature; 48.9% commerce).

Papers devoted to concept papers or methodological development: only 8.1% in commerce (cf 44.2% defense; 52.3% healthcare).

I have a QUALITY MANAGEMENT problem which is at the DEMAND FORECASTING stage, and for which I now need to make some predictions that will provide me with a STRATEGIC OVERVIEW, and we are only looking for TRENDS at this stage. I have about A MONTH to design a nurse-led community service in support of people with diabetes. I have NO BUDGET, but our team of five is EXPERT in delivering this service. In terms of numbers, we can furnish some GUESTIMATES and we have some RAW DATA.
A typical output

RIGHT Method Selection Tool - Demo Results

(Version 5.2 Beta)

The values you have submitted are:

Q1. To which of these application areas / functional types does your problem belong?
   - Quality management
   - Risk management
Q2. To which of these stages does your problem belong?
   - Demand forecasting
   - Resource allocation
Q3. What is the level of insight that you require from modelling?
   - Analytical
   - Managerial
   - Operational
Q4. What is the type of output that you require?
   - Detailed answers
   - Outputs
Q5. What is the maximum amount of time that you can allocate for modeling, to solve this problem?
   - Less than a year
Q6. What is the maximum amount of money available to purchase hardware, software and expertise to solve this problem?
   - Up to £5000
Q7. What is the maximum amount of knowledge that you have, or could access in a timely way, of the system/problem?
   - Expert knowledge
Q8. What is the maximum amount of quantitative data that you have, or could access in a timely way, about the problem?
   - Some raw data

Some of the following methods may prove useful.
(Provided in no particular order):

Discrete Event Simulation

The operation of a system is represented as a chronologically-linked sequence of events in order to describe flows of people and/or material and explore the effects of any changes.

Discrete event simulation is best suited to analysing systems that can be modelled as a series of queues and activities, for example, an Emergency Department or clinic. Individual patients are modelled as they pass through the system, allowing for variability and uncertainty in behaviour. This allows potential impacts to the system or patients to be estimated, and can help answer "what if" questions, before changes are made to the real system.

Main applications include:
- System (re)design at operational/strategic levels
- Scheduling, resource allocation, staffing, waiting list management and patient pathway design

Outputs expected:
- Quantitative estimation of system performance
Value-driven innovation

Economic Evaluation Tool for Early Assessment of Value

MATCH

Phase 1  B  Phase 3  C  Phase 4  D  Phase 5

Business Plan
Innovation in healthcare

Value-driven innovation

Service improvement

interface

Investment

Cost

Market

No. of units produced

The home straight

- Innovation in healthcare is hard:
  - Dysfunctional interaction between cycles
- We have focused on:
  - Produce tools for early decision-making
  - Investment & Strategic Planning
  - Connecting up to the service layer (just)
- With better value tools, innovation becomes easier