Investigating the Costs and Benefits of ICT Use in Personalized Healthcare: A Case-Based Approach

Walter Van Dyck, Daniel Gassull, Gergely Vértes, Prateek Jain, Muhilan Palaniappan, and Erik Tambuyzer
Does technology-enabled personalisation allow for a move from pure play drug-based to integrated healthcare solutions?

For both cases we studied;

1. Cost Effectiveness analysis and impact on various healthcare players

2. Cost-Benefit analysis: NPV, IRR, sensitivity analysis
Unlocking the Value of Personalised Healthcare in Europe—Breast Cancer Stratification (2012) and
Unlocking the Value of Personalised Healthcare in Europe—Cardiovascular Disease Prevention, Diagnostic and Telemonitoring Technology (2012)

In *Health Policy and Technology*, forthcoming

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Case Study 2: Acute Coronary Syndrome
ACS Current Treatment Scenario (Simplified)
Based on the clinical guidelines of European Society of Cardiology

Symptom
- Chest pain

Primary Care
- GP
- Stable Angina
- ACS Free
- Unstable Angina
- AMI

Secondary Care
- ER
- Columel: Stable Angina
- ER
- Columel: Unstable Angina
- ER
- Columel: ACS Free
- ER
- Columel: AMI

Diagnosis
- Symptom

Medication Treatment
- Medication
- Non-adherence
- adherence

Surgery
- Angioplasty (PCI)
- CABG (Bypass)
- Rehabilitation
- Non-adherence
- adherence

Rehabilitation
- Non-adherence
- adherence

Our data is Based on:
Cost: Acute coronary syndromes in Europe: 1-year costs and outcomes (York Health Economic Consortium Ltd.) Taylor MJ, Scuffham PA, McCollam PL, Newby DE.
Probabilities: Actual Patient Data (Belgian patient sample) with Dr. Frank Buntix (GP) and Dr. Marc Sabbe (UZ Leuven).
Primary Prevention

- Definition
  - “Primary prevention generally involves the prevention of disease and conditions before their biological onset.”

- In our analysis we used physical activity as a proxy to represent primary prevention
  - Cost impact considered
    - Subsidizing weekly exercise to high risk citizens,
    - National awareness campaign promoting exercise
Primary Prevention: Model impact

### Per patient INVESTMENT

<table>
<thead>
<tr>
<th></th>
<th>Cost/year</th>
<th>Impact description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Prevention</td>
<td>400 €</td>
<td>Reduction of 10% of incidence rate.</td>
</tr>
</tbody>
</table>

### Incidence Rate Reduction by 10%

- **Cycle**: Prevention
  - **Primary Care**: Symptom → GP → Stable Angina
  - **Secondary Care**: Diagnosis → ACs Free → Unstable Angina → AMI
  - **Secondary Care**: Diagnosis → ACS Free → Stable Angina
  - **Secondary Care**: Diagnosis → Unstable Angina
  - **Secondary Care**: Diagnosis → AMI
  - **Secondary Care**: ER → CABG (Bypass) → Rehabilitation
  - **Secondary Care**: ER → PCI (Angioplasty) → Rehabilitation
  - **Rehabilitation**: adherence → Non-adherence
  - **Surgery**: adherence → Non-adherence

- **Prevention**: Exercise, Lifestyle intervention program
Point of Care technology

- **Definition**
  - “Laboratory and other services provided to patients at the bedside. These include diagnostic and laboratory testing.”

- **Representational technology used: I-Stat (Abbott)**
  - “Advanced handheld and test cartridge blood analysis system that delivers Lab-quality results”
  - Commercially available but not reimbursed yet in Europe.
    - Biosensor technology enables patient side blood testing,
    - Real time data within minutes rather than hours
Point of Care technology: Model impact

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<tr>
<td>POC Technology</td>
<td>800 €</td>
<td>Cost of blood test reduced &amp; a reduction of ER as a first point of contact by 5%.</td>
</tr>
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</table>

The cost of POC varies by country.
Tele-health monitoring programs

Definition

- “The use of electronic information and telecom technologies to support long-distance clinical healthcare, health related education, public health and health administration.”

Representational technology used: Health Buddy (Bosch)

- Connects patients in their homes to their care providers claimed to increase adherence to medication to 94%
- Compatible devices: Blood glucose, blood pressure, weight scale (not considered)
Tele-health monitoring: Model impact

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<td>Tele-health monitoring</td>
<td>1200 €</td>
<td>Increase of adherence to medication from 34% to &gt;60%. Reduction of hospital admission by 10%.</td>
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Diagram:
- Chest pain
  - Primary Care
    - GP
    - Stable Angina
    - ACS Free
    - Unstable Angina
    - AMI
  - Secondary Care
    - Diagnosis
    - Medication
    - Telemonitoring
    - Rehabilitation
    - Non-adherence
    - Adherence
  - Surgery
    - PCI (angioplasty)
    - CABG (Bypass)
    - ER
    - Rehabilitation
    - Non-adherence
    - Adherence
  - Rehabilitation
    - Telemonitoring
    - Non-adherence
    - Adherence
  - ER
  - +

Per patient INVESTMENT Cost/year Impact description
Tele-health monitoring 1200 € Increase of adherence to medication from 34% to >60%. Reduction of hospital admission by 10%.
RESULT 1: Increases in QALY shows that all three interventions should be implemented (UK data shown)

<table>
<thead>
<tr>
<th>Health Care Intervention</th>
<th>Δ Cost (€)</th>
<th>Δ QALY</th>
<th>INB (€)</th>
<th>IHB (QALY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Prevention (exercise)</td>
<td>292</td>
<td>0,018</td>
<td>927</td>
<td>0,026</td>
</tr>
<tr>
<td>Point of Care Technology (remote testing)</td>
<td>480</td>
<td>0,006</td>
<td>690</td>
<td>0,019</td>
</tr>
<tr>
<td>Tele-Health Monitoring</td>
<td>-3008</td>
<td>0,019</td>
<td>3674</td>
<td>0,104</td>
</tr>
<tr>
<td>TOTAL (3 Technologies combined)</td>
<td>-3164*</td>
<td>0,036</td>
<td>4424</td>
<td>0,126</td>
</tr>
</tbody>
</table>

*Interventions impact different populations sizes based on probabilities and do not sum vertically

INB= Incremental Net Monetary Benefit (€)
IHB= Incremental Health Benefit (QALY)
WTP = Willingness to Pay (€35k / QALY)
Cost reduction achieved by the 3 interventions in the analyzed 3 countries:

- 46%
- 33%
- 30%
RESULT 2: Reduced incidence of ACS and doubling of ‘healthy’ citizens in the cohort population (UK data shown)

Intervention Impacts

- 15%  - 13%  + 250%

- Stable Angina
- Unstable Angina
- ACS free

Current Scenario
Investment Scenario
RESULT 3: Cost effectiveness of ACS after implementation of three interventions assuming 70% adherence (UK data shown)
RESULT 4: Reduced healthcare consumption and increased utilization of less costly pathways (UK data shown)
RESULT 5: Cost of Operation and Savings of Each Intervention (UK data shown)