Population Health Analytics: Lessons from the Vanguards

Geraint Lewis
Chief Data Officer
What do we mean by the term ‘Population Health Management’?

A local health system that:
• integrates primary care, secondary care and community health services with public health, social care and Third Sector organisations
• manages a **defined budget** on behalf of a **defined geographical population**
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...uses evidence and person-level analysis to:
• **understand** the health needs and wellbeing of its population and **identify opportunities** to improve the quality, efficiency and equity of the care being provided
• inform the **planning and investment** in a range of coordinated, evidence-based, cost-effective health, care and societal interventions
• **monitor and evaluate** those interventions to learn what works for whom, where and why
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...in order to:
• reduce health inequalities
• achieve the Triple Aim of healthcare (higher quality care, better patient experience, lower per capita cost)
• improve the long-term health and wellbeing of the people it serves.
• Online community
• Documents
• Discussions
• FAQs
• Webinars
• Films
• Conferences
• Master-classes
• Study visits
I. Fundamentals

II. Intelligence

III. Transformation
Learning Cycle

1. Needs Assessment
2. Opportunity Analysis
3. Impact Assessments
4. Implementation
5. Evaluation and Feedback
6. Transparency
1. Needs Assessment

- Understanding the needs of the population and its subpopulations

- Subpopulations:
  - Age-based (e.g. toddlers)
  - Geographic (e.g. high-need estate)
  - Ethnic groups
  - Risk-based groups
  - Disease-based groups
  - Socially excluded (e.g. ex-offenders, sex workers)
  - Data-driven clusters
Individual patient timelines
(Theograph)
Aggregated patient timelines

(Bow Tie Analysis)
### Last 2 years

<table>
<thead>
<tr>
<th>Condition Details</th>
<th>PAM Score &amp; Level</th>
<th>Key Outcomes</th>
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<tr>
<td>0000013229</td>
<td>Anxiety</td>
<td>Days in hospital: 706 / 730</td>
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<tr>
<td>000 001 3229</td>
<td>PAM Score 59.6</td>
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<td>PAM Level 3.6</td>
<td>Has GP care plan</td>
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<tr>
<td></td>
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<td>Care plan up to date</td>
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<tr>
<td></td>
<td></td>
<td>Community care user</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mental health user</td>
</tr>
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<td>Social care user</td>
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<th>1 Jul 16</th>
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<td>1 Jul 16</td>
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<td></td>
<td>1 Oct 16</td>
<td>1 Jan 17</td>
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<tr>
<td></td>
<td>1 Apr 17</td>
<td>11 visit(s)</td>
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<table>
<thead>
<tr>
<th>Care Type</th>
<th>Emergency support</th>
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<tbody>
<tr>
<td>Full Date</td>
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<tr>
<td>Setting Of Care</td>
<td>Non-elective inpatient (Acute)</td>
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<td>Provider</td>
<td>CHELSEA AND WESTMINSTER HOSPITAL NHS FOUNDATION TRUST</td>
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<tr>
<td>Reason</td>
<td>Tendency to fail, not elsewhere classified</td>
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<tr>
<td>Outcome</td>
<td>Wa22V - Other specified admissions and counselling with Major CC</td>
</tr>
<tr>
<td>Cost group</td>
<td></td>
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<tr>
<td>GP Event Staff Type</td>
<td></td>
</tr>
<tr>
<td>GP Event Location</td>
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</tr>
<tr>
<td>Length Of Stay</td>
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</table>
2. Opportunity Analysis

- Studying the data for opportunities to improve the quality, equity or efficiency of care
- Approaches:
  - Unwarranted variation
  - Gaps in care
  - Duplications in care
  - Triple Fail events
2.1 Unwarranted variation the quality, equity or efficiency of care
2.2 Duplications in care
(e.g. cholesterol test ordered twice)

2.3 Gaps in care
(e.g. overdue blood pressure check)

2.4 Missed diagnoses
(e.g. atrial fibrillation)

2.5 Triple Fail Event
(i.e. poor quality, unpleasant and costly)
(e.g. unplanned hospital admission or starting haemodialysis too early)
Risk Stratification

Risk of $x$ during time period $y$

Risk of **unplanned hospital admission** in the **next 12 months**

Risk of **developing a bed sore** in the **next 6 weeks**
Predictive Risk Model

Whole population

People at high risk of the adverse event

Impactability Model

People at high risk who will benefit from the preventive intervention
Approaches to impactibility modelling

• “traditional methods” of prioritising patients with
  • high gap score
  • high weighted gap score
  • one or more ambulatory care sensitive conditions

• De-prioritise patients with
  • stable characteristics (e.g. expensive, long-term drug)
  • extremely high risk
  • unfavourable characteristics (psychosis, language barrier)

• Impactible moments (e.g. post discharge from hospital)

• Rising risk score

• “Matthew’s method” (i.e. prioritising patients whose illness is higher than expected based on their complexity)

• “Data-driven” methods (i.e. using machine learning or other methods to predict which high-risk patients will benefit most from any given preventive intervention)
  • Propensity to be contacted (>= 1 completed phonecall with case manager)
  • Propensity to engage (>= 3 completed phonecalls)
  • Propensity to complete the preventive programme
  • Propensity to benefit from the preventive programme

• Patient activation
3. Impact Assessments

• Series of checks
• Safeguard:
  • Privacy
  • Equity
  • Ethics
  • Finances
3.1 Privacy Impact Assessment

3.2 Equality Impact Assessment

3.3 Ethical Impact Assessment

Prerequisites for the Stratified Approach to the Triple Aim

1. The Triple Fail event should be an important health problem.
2. There should be an intervention that can mitigate the risk of the Triple Fail event.
3. There should be resources and systems available for timely risk stratification and preventive interventions.
4. There should be sufficient time for intervention between stratification and the occurrence of the Triple Fail event.
5. There should be a sufficiently accurate predictive risk model for the Triple Fail event.
6. The predictive risk model and impactability model should be acceptable to the population.
7. The natural history of the Triple Fail event (i.e., the practices and processes that typically lead to the event) should be adequately understood by the organization offering the preventive intervention.
8. There should be an accepted policy about who should be offered the preventive intervention.
9. The cost stratification should be “economically balanced” (i.e., it should not be excessive in relation to the cost of the program as a whole).
10. Stratification should be a continuous process, not just a “once and for all” occurrence.
Next Steps for Risk Stratification in the NHS

False Positives
- Intervention “wasted”
- Needless anxiety
- Over-investigation
- Over-treatment

False Negatives
- Unwarranted reassurance
- Delayed presentation
3.4 Financial Impact Assessment

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<th>Risk score threshold</th>
<th>Assumed rotation in admissions (%)</th>
<th>No. (%) patients identified</th>
<th>No. (%) patients flagged incorrectly (not admitted)</th>
<th>Total cost (£) of intervention</th>
<th>Admissions within 12 months for correctly flagged patients</th>
<th>Intervention savings (£) (£2100/admission)</th>
<th>Net savings or loss (£)</th>
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<td>309 (54.3)</td>
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<td>508 060</td>
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1. Chosen risk score threshold
2. Effectiveness of the intervention
3. Cost of the intervention

= net savings
1. Needs Assessment
2. Opportunity Analysis
3. Impact Assessments
4. Implementation
5. Evaluation and Feedback
6. Transparency
4. Implementation

- Evidence-based
- Co-designed with patients and clinicians
- Multiple channels
  - Website
  - Apps
  - Call centre
  - Pharmacy
  - Patient groups
  - Direct mail
4. Implementation

Operational Dataset

4.1 Notifications about gaps in care

Dataset is updated once the gap has been closed

4.2 & 4.3 Notifications about eligibility for preventive care

Based on risk of experiencing the Triple Fail event (4.2 predictive model) and likelihood to benefit from preventive care (4.3 impactability model)

4.4 Diagnosis stratification for risk of “missed” diagnosis such as atrial fibrillation
Summary

1. Needs Assessment
   1.1 Data needs analysis
   1.2 Joint Strategic Needs Assessment
   1.3 Analyses of person-level linked data
   1.4 Individual and aggregated timelines

2. Opportunity Analysis
   2.1 Unwarranted variation?
   2.2 Duplications in care?
   2.3 Gaps in care?
   2.4 Missed diagnoses?
   2.5 Triple Fail events?

3. Impact Assessments
   3.1 Privacy Impact Assessment
   3.2 Equality Impact Assessment
   3.3 Ethical Impact Assessment
   3.4 Financial Impact Assessment

4. Implementation
   4.1 Gap identification and closure
   4.2 Predictive models
   4.3 Impactibility models
   4.4 Diagnosis stratification
   4.5 Changing pathways of care

5. Evaluation and Feedback
   5.1 gap analysis
   5.2 predictive models
   5.3 impactibility models
   5.4 Evaluate

6. Transparency
   6.1 Publish methodology
   6.2 Publish findings

Continually update:
5.1 gap analysis
5.2 predictive models
5.3 impactibility models
5.4 Evaluate
Transformation

...so as to:

• achieve **continual improvement** for citizens, patients and the taxpayer
Data-driven Leadership
Informed Customers of Analytical Services
Changing service delivery and the service model to reflect the analytical findings
Capacity Command Centre
Getting involved

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