Integrated Care Matters

#ICMatters
IFIC is a non-profit members’ network that crosses organisational and professional boundaries to bring people together to advance the science, knowledge and adoption of integrated care policy and practice.

The Foundation seeks to achieve this through the development and exchange of ideas among academics, researchers, managers, clinicians, policy makers and users and carers of services throughout the World.
‘Integrated Care Matters’

Monthly Webinars

- User and carer perspectives
- Home and Away presentations
- Facilitated Discussion – add questions & reflections to chat box
- Knowledge Tree of topic resources
- Up and coming Webinars
Some Simple Tweaks

https://vimeo.com/72858298
Risk Prediction for Improving Health and Care in Scotland

Ahmed Mahmoud
Principal Information Analyst

Health and Social care Integration Team
Information Services Division

Population Risk Stratification Approaches

15th December 2016
Under 75 Mortality

Source: National Records of Scotland (NRS)
Multimorbidity in Scotland\textsuperscript{1}

Emergency Admissions with age-sex standardised admissions rates

Age-Sex standardised admission rates per 100,000 (Scotland)

- Males
- Females
- Both Sexes

Year:
- 2010/11
- 2011/12
- 2012/13
- 2013/14
- 2014/15
Emergency hospital admissions for patients aged 75+

Admissions Thousands

Year

- Projected

Emergency hospital admissions for patients aged 75+

Admission

Thousands

- Projected

Year

2005 2010 2015 2020 2025 2030 2035
Every week in Scotland data are collected on:

1,000 Births
15,000 Out of Hours attendances
20,000 Screened for cancer
30,000 Hospital discharges
30,000 A&E attendances
40,000 NHS eye exams & tests
90,000 NHS dental treatments
200,000 Outpatient clinic attendances
500,000 GP practice consultations
2,000,000 Drugs dispensed
SPARRA - Scottish Patients at Risk of Readmission & Admission - quantifies risk in coming year.

- SPARRA scores (%) calculated monthly for approx 4.2 million patients (80% of population) - Currently 1st November 2016 to 31st October 2017

- Data for patient risk stratification provided to Health Boards and to General Practices
SPARRA for Case Finding

- SPARRA stratifies on basis of risk of hospital admission in the next 12 months.
- Targeting patients most likely to benefit from interventions (medium-high risk)
- SPARRA helps identify patients who may benefit from preventative approach
SPARRA Risk Factors & Datasets

- How many previous emergency admissions has the patient had?
- What age is the patient?
- What type of outpatient appointments did the patient have?
- Any A&E attendances in the past year?
- Any prescriptions for e.g. dementia drugs? Or substance dependence?
- Any previous admissions for a long term condition (such as epilepsy?)
- How many prescriptions?
- How many outpatient appointments?
- Any recent admissions to a psychiatric unit?
- How many previous admissions for a long term condition (such as epilepsy?)

OUTCOME PERIOD

OUTCOME PERIOD

PRE-PREDICTION PERIOD
SPARRA Cohorts - Adults

- Over 75 (Frail elderly)
  - Frail Elderly
    - Age
    - Deprivation
    - Prescription in specific BNF chapters
- Younger ED
  - All cohorts
    - Emergency / elective / daycase admissions
- Younger Emergency Department
  - LTC related admissions
    - ED attendances
    - New OP attendances
  - Alcohol/substance misuse related admissions
- Younger Emergency Department
  - Prescription for specific groups of drugs
  - New OP attendances for MH

Long Term Conditions - aged 16-74

- LTC
  - Psychiatric admissions
  - Prescriptions/admissions indicating particular conditions
  - Deprivation
Case finding and SPARRA

- How many patients are at risk of having at least 1 emergency admission in the coming year?
- Who are they and what are their characteristics (age, LTCs, etc)?
- Where are they located - what GP are they registered with?
Risk score distribution for Average GP Practice

~ 5% of practice population

No. of patients

0 500 1000 1500 2000 2500 3000 3500 4000 4500

Risk Group

0-10% 10-20% 20-30% 30-40% 40-50% 50-60% 60-70% 70-80% 80-90% 90-100%
Anticipatory Care Plan (ACP)

Anticipatory Care Continuum of Risk

People With low risk of emergency admission - simple Information & advice

People at Moderate Risk of emergency admission - ACP to be Developed by GP & practice team

Patients at highest risk - most likely to be receiving care or manage by the Community Team – ACP already in place
Nationally: GPs use SPARRA scores to aid in the selection of patients ACP / Polypharmacy Review.

NHS Lothian: high resource users with high SPARRA scores are followed for 1 year (evaluation of ACPs & costs)

NHS Grampian: SPARRA patients with alcohol/drug admissions and highlight to their GP.
Nationally: Mapping of aggregated SPARRA data by risk quintile/LTC to data zones to identify specific areas of need.

Various NHS Health Boards/Groups: Use SPARRA to aid in service profiling and needs assessment

Nationally: Integration of SPARRA data into local dashboards and reporting tools
Health and Social Care Integration

There's no ward like home
Enhancing SPARRA

1. Improve and refine current logistic regression method
   - Model review
   - Additional data sets

2. Focus on Ambulatory Care Sensitive Conditions
   - Identify the subset of emergency admissions that might be prevented in the community

2. Use alternative method
   Other Machine Learning Methods could be more suitable to the data. We are investigating Random Forest
Thank You

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http://www.isdscotland.org/Health-Topics/Health-and-Social-Community-Care/SPARRA/
Health risk assessment and stratification in an integrated care scenario

Josep Roca, MD. PhD

Hospital Clínic. IDIBAPS. University of Barcelona
Agenda

✓ Dynamic health risk assessment & stratification
✓ Assessment of population-based risk assessment tools
✓ Enhanced clinical health risk assessment
✓ Toward personalized medicine
✓ Roadmap for deployment
Dynamic health risk assessment & stratification

- Population-based health risk assessment tools
- Enhanced clinical risk assessment – service selection
- Personalized medicine
Traditional Healthcare is **reactive**

Patient with symptoms → Doctor → React
Need for **predictive** rather than reactive healthcare

using multiple sources of information to anticipate, for the individual patient, the development or progression of disease
Why?

To prevent, or reduce the impact of, disease by:

• Risk assessment

In order to enable:

• Early diagnosis

• Cost-effective interventions
Agenda

✓ Dynamic health risk assessment & stratification
✓ Assessment of population-based risk assessment tools
✓ Enhanced clinical health risk assessment
✓ Toward personalized medicine
✓ Roadmap for deployment
Advancing care coordination and Telehealth deployment

ACT program

Feb 2013 – Oct 2015 from March 2016 …
Aims

✔ Comparison of health risk assessment tools among the ACT regions
✔ Comparison of health indicators
✔ Proposals for enhanced clinical risk assessment strategies
Population-based risk assessment
Comparison of predictive risk modeling among 5 regions (OPIMEC)

Purposes

• To design health policies (*service comissioning*)

• To identify patients at risk for unexpected health events
### Barriers for comparisons

<table>
<thead>
<tr>
<th>Scope of the stratification strategy</th>
<th>Basque</th>
<th>Catalonia</th>
<th>Groningen</th>
<th>Lombardy</th>
<th>Scotland</th>
<th>Barriers for comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entire population (population health)</td>
<td>Population (population health)</td>
<td>Programme (population medicine)</td>
<td>Programme (population medicine)</td>
<td>3.4 million people (toward population health)</td>
<td>Heterogeneous predictive modelling tools</td>
</tr>
<tr>
<td>Current predictive modelling tool</td>
<td>ACG-PM</td>
<td>CRG</td>
<td>Not available</td>
<td>CReG, evolving toward a risk predictive modelling tool</td>
<td>SPARRA v3 (owned by the region)</td>
<td>Different statistics describing predictive power, different levels of flexibility</td>
</tr>
<tr>
<td>Risk categories (%)*</td>
<td>High</td>
<td>1.3</td>
<td>3.4</td>
<td>3.0</td>
<td>0.7</td>
<td>Different criteria for risk categories leading to non-comparable population distributions</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>5.5</td>
<td>10.8</td>
<td>40.9</td>
<td>2.0</td>
<td>Heterogeneity of reporting allowed conceptual consensus but not comparability of results</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>22.8</td>
<td>34.7</td>
<td>56.1</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Healthy</td>
<td>70.4</td>
<td>51.1</td>
<td>–</td>
<td>90.6</td>
<td></td>
</tr>
<tr>
<td>Characteristics of reporting on top indicators</td>
<td>Regional and microsystems</td>
<td>Regional and four areas</td>
<td>Three programmes</td>
<td>GReG cohorts</td>
<td>Subregion</td>
<td></td>
</tr>
</tbody>
</table>

*Estimations of risk-strata distribution corresponds to 2012.

ACG-PM, Adjusted Clinical Groups-Predictive Model; ACT, Advancing Care Coordination and Telehealth Deployment; CReG, Chronic-Related Group; SPARRA V3, Scottish Patients at Risk of Readmission and Admission V.3.
### Table 3: Recommendations for good practice population-based health risk assessment

<table>
<thead>
<tr>
<th>Domain</th>
<th>Recommendations</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of risk stratification tool</td>
<td>Predictive model using a population health approach</td>
<td>High(^{15-21})</td>
</tr>
<tr>
<td>Validation of the model</td>
<td>Longitudinal follow-up</td>
<td>High(^{41})</td>
</tr>
<tr>
<td>Predicted/explained outcomes</td>
<td>Unplanned hospital-related events; risk of institutionalisation; death; case</td>
<td>High(^{15-21})</td>
</tr>
<tr>
<td>Source sample</td>
<td>Whole regional population</td>
<td></td>
</tr>
<tr>
<td>Statistical model</td>
<td>Predictive modelling</td>
<td>High(^{15, 16})</td>
</tr>
<tr>
<td>Statistical indices</td>
<td>Standardisation on reporting performance (positive predictive value, PPV(^{41})) and sensitivity across risk bands</td>
<td>Moderate(^{41*})</td>
</tr>
<tr>
<td>Population usefulness</td>
<td>Risk adjustment; planning and commissioning health services</td>
<td>High(^{22-24})</td>
</tr>
<tr>
<td>Clinical and social usefulness</td>
<td>Identification of patients at high risk and cost-effective preventive clinical</td>
<td>High(^{15-22})</td>
</tr>
<tr>
<td></td>
<td>and social interventions</td>
<td></td>
</tr>
<tr>
<td>Periodicity of updates</td>
<td>Semester</td>
<td>Low(^{†})</td>
</tr>
<tr>
<td>Clinical accessibility</td>
<td>Available in the professional workstation through clinical decision support</td>
<td>High(^‡)</td>
</tr>
<tr>
<td></td>
<td>systems</td>
<td></td>
</tr>
<tr>
<td>Flexibility and transferability</td>
<td>Open algorithms, open source, reduced or no licence binding. Morbidity groupers</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>based on statistical criteria adjusted to the target population</td>
<td></td>
</tr>
</tbody>
</table>

*To report metrics indicating sensitivity/specificity of predictions is recommended for good practice. However, some regions adopt a pragmatic approach classifying individuals into specific of the risk-strata pyramid without informing on sensitivity/specificity because of rather poor robustness of predictions provided by most of the models.

†Periodicity of updates depends on the logistics available in each site. A yearly or 6-monthly basis seem reasonable.

‡Development of adequate clinical decision support systems (CDSS) depends on three main factors: (1) robustness of computational modelling feeding the CDSS; (2) refinement of the CDSS generated by the clinical feedback and (3) appropriate dashboard providing a user-friendly interface.
Population-based risk assessment

Conclusions

✓ Consensus on the need of population-based health risk assessment

✓ Need to overcome current limitations due to:
  • License binding constraints
  • Insufficient public availability of algorithms; and/or
  • Rigidity of some computational algorithms
Comparison of health indicators among ACT regions

WP 5 population-based
Comparison of health indicators among ACT regions

WP 5\text{\textsubscript{patient-based}}
Comparison of health indicators among ACT regions

The two main limiting factors for the ACT purposes were:

(i) differences in the disease coding;
(ii) different modalities of data reporting and logistic limitations
    *(levels of data aggregation)* at regional level.

The latter was the most important factor precluding realization of the tasks as initially planned
Proposals for enhanced clinical risk assessment
Proposals for enhanced health risk assessment and stratification in an integrated care scenario

Ivan Dueñas-Espín,1,2 Emili Vela,3 Steffen Pauws,4 Cristina Bescos,5 Isaac Cano,1 Montserrat Cleries,3 Joan Carles Contel,6 Esteban de Manuel Keenoy,7 Judith Garcia-Aymerich,2 David Gomez-Cabrero,8 Rachelle Kaye,9 Maarten M H Lahr,10 Magí Lluch-Ariet,11,12 Montserrat Moharra,13 David Monterde,14 Joana Mora,7 Marco Nalin,15 Andrea Pavlickova,16 Jordi Pica,17 Sara Ponce,7 Sebastià Santaeugenia,17 Helen Schonenberg,5 Stefan Störk,18 Jesper Tegner,8 Filip Velickovski,11,19 Christoph Westertéicher,5 Josep Roca1
Patient-based health risk assessment

Areas for action

• Transfer outcomes of population-based health risk assessment for a given individual into clinical decision making (*use patient allocation into the risk stratification pyramid as a covariate*)

• Elaborate strategies for individualized prediction based on a multidimensional approach
Population-based health risk prediction & stratification

**GMA – Adjusted Morbidity Groups**

- Columns 1 and 2 - GMA levels by percentiles of the entire population
- Columns 3 and 4 - Rates of mortality and hospital admissions
- Column 5 - Cost per inhabitant per year expressed in €
- Column 6 (last) - % total healthcare expenditure by risk strata.

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**Catalonia – Whole Population Morbidity Dataset**

- Size – 7.5 million inhabitants
- Periodic update – every 6 months
- Variables – Use of healthcare resources, Incidence & Prevalence of key disorders, Pharmacy, Adjusted Morbidity Groups (GMA)
- Outcomes – Population stratification, Risk assessment of clinical use

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- Table of insured people
  - PDC: individual medical status
  - Number of inhabitants: 921,658

- Table of diagnosis:
  - PDC: codes, data of diagnostic Procedures, Specialties
  - Number of inhabitants: 135,326

- Table of healthcare contacts
  - PDC: contact data, type of provider, urgent, non-urgent
  - Number of inhabitants: 235,475

- Table of active principles
  - PDC: type of active principle, information units, concentration
  - Number of inhabitants: 47,196

- Table of clinical measurements
  - PDC: data, data, results
Preliminary results
Characteristics according to the COPD group

<table>
<thead>
<tr>
<th></th>
<th>COPD with no severe exacerbations</th>
<th>COPD severe exacerbations</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>226.891</td>
<td>25.922</td>
<td>12.017</td>
</tr>
<tr>
<td>Patients / year</td>
<td>220.850</td>
<td>24.293</td>
<td>10.737</td>
</tr>
<tr>
<td>Age* (median±SD) (years)</td>
<td>69.8 ±12.5</td>
<td>74.5 ±11.7</td>
<td>74.7 ±10.9</td>
</tr>
<tr>
<td>Women (%)*</td>
<td>36.7</td>
<td>33.7</td>
<td>27.1</td>
</tr>
<tr>
<td>Morbidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of chronic co-morbidities *</td>
<td>5,5±2.1</td>
<td>6,5±2.1</td>
<td>6,9±2.1</td>
</tr>
<tr>
<td>Stratification groups (GMA)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very high-risk stratum</td>
<td>6,6</td>
<td>17,6</td>
<td>45,2</td>
</tr>
<tr>
<td>High risk stratum</td>
<td>26,5</td>
<td>43,4</td>
<td>41,0</td>
</tr>
<tr>
<td>Moderate risk stratum</td>
<td>49,3</td>
<td>33,2</td>
<td>12,7</td>
</tr>
<tr>
<td>Low risk stratum</td>
<td>17,7</td>
<td>5,7</td>
<td>1,1</td>
</tr>
<tr>
<td>Mortality during 2015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality 2015 (%)*</td>
<td>4,9</td>
<td>11,4</td>
<td>18,1</td>
</tr>
<tr>
<td>COPD severe exacerbations 2015 (%)*</td>
<td>2,7</td>
<td>17,1</td>
<td>47,8</td>
</tr>
</tbody>
</table>
The population-based risk assessment tool (GMA) shows potential to predict (ROC)

- Use of healthcare resources (0.763)
- Mortality (0.829)
- Unplanned admissions (0.766)
- Multiple admissions (0.803)

in patients with Chronic Obstructive Pulmonary Disease
Future developments

*personalized medicine*
Digital Health Framework

*as a proof of concept*

- **PDSS**
  - Wellness
  - Social care
  - Self-management Apps

- **Personal Health Folder**

- **CDSS**
  - Hospital
  - primary care
  - Outpatient clinics
  - Integrated care

- **Biomedical research**
  - Environmental health
  - *Omics*
  - Systems biology
  - Clinical trials
Temporal disease trajectories condensed from population-wide registry data covering 6.2 million patients

Anders Boeck Jensen1,2, Pope L. Moseley2,3, Tudor I. Oprea3,4, Sabrina Gade Ellesæe3, Robert Eriksson1,2, Henriette Schmock5, Peter Björndstrup Jensen2, Lars Juhl Jensen2 & Søren Brunak1,2
Agenda

- Dynamic health risk assessment & stratification
- Assessment of population-based risk assessment tools
- Enhanced clinical health risk assessment
- Toward personalized medicine
- Roadmap for deployment
Personalized care for chronic patients in an integrated care framework (2016-2019)

Regional deployment of ICT-supported integrated care services

design, evaluation and large scale implementation of five actions aiming at generating healthcare-value at system level

Multimorbidity
(cardiovascular diseases; COPD; diabetes type II and anxiety-depression)
NEXTCARE – Innovation in Integrated Care Services for Chronic Patients

Five strategic actions with a three stages lifecycle

- **A1**: Prediction of clinical risk and stratification
- **A2**: Self-management and promotion of healthy lifestyles
- **A3**: Management of Complex Chronic Patients and prevention of exacerbations
- **A4**: Forced Spirometry program
- **A5**: Digital Health framework for interoperability at Catalan level

Adaptive case management system - Dashboard

Primary care

Specialized care

Social care

Informal care environment
Conclusions

✓ Need for population-based health risk assessment tools with potential to match evolving needs
✓ Standardization of health indicators
✓ Assess enhanced clinical risk assessment
✓ Foster convergence of integrated care & personalized medicine
Thanks to the leaders of the GMA team

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Webinar Dates for Your Diary

- Anticipatory Care Planning  Jan 13th
- House of Care  Feb 9th
- Enhanced Interdisciplinary Care in Localities  Mar 15th

Volunteer presenters for future webinars welcome

Contact  anne.hendry@lanarkshire.scot.nhs.uk
Thank You

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- Share a blog
- Send Marie your resources to upload
- Involve your colleagues in future webinars

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