Is aging just an addition of chronic diseases?

The impact of multimorbidity on health outcomes and health service use in the Veneto population

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Regione del Veneto
Multimorbidity and public health: challenges and opportunities

Challenges
- Demographic transition. Epidemiologic transition
- Big Data. A treasure to discover
- Cost variability. High cost high need patients
- Chronic vs acute, NCD vs communicable diseases

Tools and opportunities
- Changing scenarios
- New sources of epidemiological data
- New technologies and new tools to describe disease burden
- New approaches to multimorbidity
- Care integration and person centered approach
- Cost variability
- High cost high need patients
- Chronic vs acute, NCD vs communicable diseases
- New expectations and preferences of patients
Changing scenarios
PERCENT DISTRIBUTION BY AGE AND GENDER: 1994, 2014
PROJECTIONS 2040 AND 2060

Fonte: Elaborazioni dell’Ufficio di Statistica della Regione del Veneto su dati Istat e previsioni Eurostat
Comorbidity is the concurrent existence of one or more unrelated conditions in an individual with any given condition. Multimorbidity is the co-occurrence of biologically unrelated illnesses.
The high frequency of comorbidity makes it inappropriate to focus on single diseases.
Most people with any long term condition have multiple conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
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<td>22</td>
<td>18</td>
<td>36</td>
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</table>

This condition only | This condition + 1 other | + 2 others | + 3 or more others

Multimorbidity is common

Multimorbidity is socially patterned
Mental health problems are strongly associated with the number of physical conditions.
NCDs and multimorbidity are the norm in Regione Veneto

UOMINI media = 1.8
DONNE media = 2.4

N. of chronic conditions

PROVA: Progetto Veneto Anziani (Corti, JAGS 2003)
Population by number of chronic conditions and age. Tutti gli assistiti. ACG data. Year 2015. Regione Veneto
Comorbidity in subjects with specific conditions
ACG data. Year 2015. Regione Veneto

(*) grado moderato/grave, solo da diagnosi
(**) infarto acuto del miocardio escluso
Signora Maria

79 year old widow
Retired, lives alone
Income: SS, pension
Daughter, lives 10 Km away with three teenagers

Five chronic conditions
1 GP
Eight medications
In 2015 she experienced:

- 20 prescriptions, 8 meds
- 19 outpatient visits
- 3 hospital admits
- 6 weeks sub acute care
- 5 months home care
- 4 ER visits
- 6 community referrals

Administered by: 8 Physicians, 3 Social Workers, 5 Physical Therapists, 4 personal assistants, 37 Nurses

TOTAL COST OF HEALTH CARE = 24,000 Euros
Today’s Care for NCDs is:

- Fragmented
- Hard to access
- Inefficient
- Unsafe
- Expensive

One quarter of all seniors have 4+ chronic conditions and account for 80% of health care spending
New technologies and new tools to describe disease burden
Use of ACG system

ACGs were designed as a way to measure the “medical need” of populations – recognizing that patients usually present with “morbidity profiles”, not a single specific disease.

- Risk Adjusted Payments
- Population Stratification
- High Risk Case Identification
- Medical Homes and Primary Care support
- Comparative Effectiveness Research
- Performance measurement
Health-Care Datasets

- Hospital Discharges (monthly)
- ER Visits (monthly)
- Ambulatory Visits (monthly)
- Home Care visits (quarterly)
- Medications (monthly)
Integration starts from data: innovative tool for risk adjustment: ACG

**Input**
- Population
- Diagnoses
- Drugs
- Costs
- Resource use
- Treatments

**Person centered ACG* System for case-mix adjustment**

**Output**
- Disease prevalence & distribution:
  - Diagnoses (EDC, major EDC)
  - Drugs (RxMG, major RxMG)
- Disease burden:
  - ADG (Aggregated Diagnosis Groups)
  - ACG (Adjusted Clinical Groups)
  - RUB (Resource Utilization Bands)
- Future use of resources:
  - Future cost prediction
  - Probability of high cost
  - Probability of hospital admission (unplanned)
ACG 5110  Costs without diagnoses (healthy users)
ACG 5200  No costs, no diagnoses (non user)
0 = In good health = 19%

1 = Symptoms development = 37%

2 = Single non-complex condition = 19%

3 = Single complex disease, Multiple simple conditions = 19%

4 = Multimorbidity and complexity = 3.3%

5 = End of life = 1%

HEALTH MANAGEMENT TOOLS

COST BY DISEASE BURDEN
The ACG risk pyramid

0 = In good health = 19%
1 = Symptoms development = 37%
2 = Single non-complex condition = 19%
3 = Single complex disease, Multiple simple conditions = 19%
4 = Multimorbidity and complexity = 3.3%
5 = End of life = 1%

PALLIATIVE CARE, 49.385
CARE COORDINATION 162.520
DISEASE/CASE MANAGEMENT 943.000
DISEASE MANAGEMENT 988.000
DIAGNOSIS 1.839.493
H. PROMOTION SCREENING 974.682

COST = 0
COST 212
COST 723
COST 2.357
COST 6.211
COST 13.020

HEALTH MANAGEMENT TOOLS
DISEASE BURDEN
ADG – Aggregated Diagnosis Groups (Esempi)

Diagnostic categories accounting for **prognostic dimensions** for diseases or conditions

01-Time Limited: Minor
03-Time Limited: Major
06-Asthma
09-Likely to Recur: Progressive
10-Chronic Medical: Stable
11-Chronic Medical: Unstable
12-Chronic Specialty: Stable-Orthopedic
21-Injuries/Adverse Effects: Minor
22-Injuries/Adverse Effects: Major
23-Psychosocial: Time Limited, Minor
24-Psychosocial: Recurrent or Persistent, Stable
26-Signs/Symptoms: Minor
28-Signs/Symptoms: Major
31-Prevention/Administrative
32-Malignancy
33-Pregnancy

- **Duration**
- **Severity**
- **diagnostic certainty**
- **Etiologia**
- **Needs for specialistic care**
# ACG aggregations based on disease burden

<table>
<thead>
<tr>
<th>RUB</th>
<th>ACG</th>
</tr>
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<tbody>
<tr>
<td>5-very high</td>
<td>5341-newborns; 6+ pat., 1+ major pat., low birth weight</td>
</tr>
<tr>
<td></td>
<td>4930-6/9 pat., age&gt;34, 3 major pat.</td>
</tr>
<tr>
<td>4-high</td>
<td>4430-4/5 pat., age&gt;34, 2+ patologie maggiori</td>
</tr>
<tr>
<td></td>
<td>1730-Pregnancy, 2/3 pat., 1+ pat. maggiori</td>
</tr>
<tr>
<td>3-moderate</td>
<td>4100-2/3 pat., age&gt;34</td>
</tr>
<tr>
<td></td>
<td>0800-Cronica, instabile</td>
</tr>
<tr>
<td>2-low</td>
<td>0900-Cronic, stable</td>
</tr>
<tr>
<td></td>
<td>0400-Acute, major</td>
</tr>
<tr>
<td>1-healthy uses</td>
<td>5110-Costs, no diagnoses,</td>
</tr>
<tr>
<td></td>
<td>0300-Acute, minor, age&gt;5</td>
</tr>
<tr>
<td>0-Non user</td>
<td>5200-No costs no diagnoses</td>
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</table>
### Criteria for assigning Diabetes diagnosis to ADG (Aggregated Diagnosis Groups)

<table>
<thead>
<tr>
<th>ICD-9 Code</th>
<th>Description</th>
<th>ADG (32)</th>
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<tbody>
<tr>
<td>250.0</td>
<td>Diabetes Mellitus Uncomplicated</td>
<td>10: Chronic Medical Stable</td>
</tr>
<tr>
<td>250.03</td>
<td>Diabetes Mellitus without complications</td>
<td>11: Chronic Medical Unstable</td>
</tr>
<tr>
<td>250.1</td>
<td>Diabetes with Ketoacidosis</td>
<td>09: Likely to Recur, Progressive</td>
</tr>
<tr>
<td>362.0</td>
<td>Diabetes Retinopathy</td>
<td>18: Chronic Specialty, Unstable-Eye</td>
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</tbody>
</table>
New sources of epidemiological data
Expanded Diagnosis Clusters – EDCs

- Hypertension, w/o major complications: 12.8
- Hypertension, with major complications: 4.2
- Type 2 diabetes, w/o complication: 3.9
- Cardiac arrhythmia: 3.4
- High impact malignant neoplasms: 2.9
- Other endocrine disorders: 2.8
- Ischemic heart disease (excluding acute myocardial...: 2.7
- Disorders of lipid metabolism: 2.3
- Cerebrovascular disease: 2.1
- Contusions and abrasions: 1.9

Prevalenza (per 100).
Scompenso cardiaco (diagnosi). Prevalenza per ETÀ e SESSO.
Anno 2015. Fonte: archivio ACG

<table>
<thead>
<tr>
<th>Età</th>
<th>Femmine</th>
<th>Maschi</th>
<th>Totale</th>
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<td>0,1</td>
<td>0,1</td>
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<td>35-44</td>
<td>0,2</td>
<td>0,1</td>
<td>0,3</td>
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<td>45-54</td>
<td>0,7</td>
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<td>55-64</td>
<td>2,0</td>
<td>6,4</td>
<td>8,4</td>
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<tr>
<td>65-74</td>
<td>6,4</td>
<td>16,4</td>
<td>22,8</td>
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<td>75-84</td>
<td>10,0</td>
<td>16,4</td>
<td>26,4</td>
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<tr>
<td>85 e oltre</td>
<td>16,4</td>
<td>15,0</td>
<td>31,4</td>
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<tr>
<td>TOT</td>
<td>0,2</td>
<td>2,0</td>
<td>2,2</td>
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COMORBIDITY OF PATIENTS WITH CHF

Scompenso cardiaco (diagnosi).
Numero di condizioni croniche per ETÀ.
Anno 2015. Fonte: archivio ACG
Population health: SMR

Major EDC = Malignancies. Prevalenza (per 100) e SMR

Prevalenza grezza  Standardized Morbidity Ratio  Rif. Regionale
RUBs Distribution by age strata  (RUBs measure of disease burden)
Distribution by age

ACG data. Year 2015. Regione Veneto
Distribution by age and disease burden (RUB)
ACG data. Year 2015. Regione Veneto
COPD

Congestive heart failure

Dementia

Diabetes

Femmine Maschi

Femmine Maschi
New approaches to multimorbidity and its impact on costs
Comorbidity, Inpatient Hospitalization, Avoidable Events, and Costs*


*ages 65+, chronic conditions only
Total cost distribution by age and disease burden (RUB).
ACG data. Year 2015. Regione Veneto
Population and costs by level of risk (RUBs)

Data from ACG, 2015
Total average cost by number of chronic conditions. ACG data. Year 2015. Regione Veneto
Does multimorbidity explain cost variability?
How multimorbidity explains cost variability?

\[
\text{costo} = a + b_1 \text{(age)} + b_2 \text{(sex)} + b_3 \text{(ACG)} + b_4 \text{(Rx-MG)} + e
\]

Dependent Variable

Demographic variables case-mix measures

performance measure of the regression model

% Variance explained (R squared)
Explaining cost variability using ACG

R² = cost variability in multiple linear regression model

- 17% age only
- +52% comorbidity
- +24% drugs

R-squared values:
- Age/Gender: 0.08
- Age/Gender + RUBs: 0.32
- Age/Gender + ACGs: 0.39
- Age/Gender/ACGs + Rx-MGs: 0.48
New approaches to multimorbidity and its characterization
The greater the morbidity burden, the greater the persistence of any given diagnosis.

That is, with high comorbidity, even acute diseases are more likely to persist.
Patients with high and very high disease burden (RUB 4 and 5) age >= 50 years by Local trusts either community based or and in Nursing Homes. ACG data. Year 2015. Regione Veneto

<table>
<thead>
<tr>
<th>Nuova Azienda ULSS</th>
<th>Non in struttura residenziale</th>
<th>In struttura residenziale</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
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<tr>
<td>1-Dolomiti</td>
<td>6.192</td>
<td>4,6</td>
</tr>
<tr>
<td>2-Marca Trevigiana</td>
<td>22.696</td>
<td>16,8</td>
</tr>
<tr>
<td>3-Serenissima</td>
<td>18.765</td>
<td>13,9</td>
</tr>
<tr>
<td>4-Veneto Orientale</td>
<td>5.730</td>
<td>4,2</td>
</tr>
<tr>
<td>5-Polesana</td>
<td>9.134</td>
<td>6,8</td>
</tr>
<tr>
<td>6-Euganea</td>
<td>26.186</td>
<td>19,4</td>
</tr>
<tr>
<td>7-Pedemontana</td>
<td>7.746</td>
<td>5,7</td>
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<tr>
<td>8-Berica</td>
<td>11.211</td>
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<tr>
<td>9-Scaligera</td>
<td>27.187</td>
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<td><strong>Totale</strong></td>
<td><strong>134.847</strong></td>
<td><strong>100,0</strong></td>
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99.5% of subjects in RUB 4 and 5 (high and very high) age >= 50 years falls into one of the following ACG categories.
First 10 EDCs (% distribution)  
N=98,401 (62% of subjects in RUB 4 and 5 age>=50 years)
First 10 EDCs (% distribution)  N=21,964 (14% of subjects in RUB 4 and 5 age>=50 years)

<table>
<thead>
<tr>
<th>EDC</th>
<th>Percentage</th>
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<tr>
<td>Hypertension, w/o major complications</td>
<td>5.6</td>
</tr>
<tr>
<td>Hypertension, with major complications</td>
<td>4.0</td>
</tr>
<tr>
<td>Cardiac arrhythmia</td>
<td>3.8</td>
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<tr>
<td>Nonspecific signs and symptoms</td>
<td>3.6</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>3.2</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>3.2</td>
</tr>
<tr>
<td>Musculoskeletal signs and symptoms</td>
<td>2.6</td>
</tr>
<tr>
<td>Ischemic heart disease (excluding acute myocardial infarction)</td>
<td>2.6</td>
</tr>
<tr>
<td>Acute lower respiratory tract infection</td>
<td>2.5</td>
</tr>
<tr>
<td>Dementia and delirium</td>
<td>2.3</td>
</tr>
</tbody>
</table>
### First 10 EDCs (% distribution)

- **Hypertension, w/o major complications**: 4.9%
- **Hypertension, with major complications**: 4.0%
- **Congestive heart failure**: 3.9%
- **Cerebrovascular disease**: 3.8%
- **Cardiac arrhythmia**: 3.8%
- **Acute lower respiratory tract infection**: 3.5%
- **Dementia and delirium**: 3.2%
- **Respiratory failure**: 3.2%
- **Nonspecific signs and symptoms**: 3.1%
- **Ischemic heart disease (excluding acute myocardial infarction)**: 2.7%
First 10 EDCs (% distribution)  
N=13,000 (8% of subjects in RUB 4 and 5 age>=50 years)

- Hypertension, w/o major complications: 6.3%
- Nonspecific signs and symptoms: 4.1%
- Hypertension, with major complications: 3.6%
- Cardiac arrhythmia: 3.4%
- Musculoskeletal signs and symptoms: 2.9%
- Cerebrovascular disease: 2.5%
- Ischemic heart disease (excluding acute myocardial...): 2.3%
- Congestive heart failure: 2.3%
- Surgical aftercare: 1.9%
- Iron deficiency, other deficiency anemias: 1.9%
First 10 EDCs (% distribution)

N=3.656 (2% of subjects in RUB 4 and 5 age>=50 years)

- Hypertension, w/o major complications: 3.6%
- Acute lower respiratory tract infection: 3.5%
- Nonspecific signs and symptoms: 3.3%
- Musculoskeletal signs and symptoms: 3.2%
- Hypertension, with major complications: 3.1%
- Dementia and delirium: 3.0%
- Congestive heart failure: 3.0%
- Cerebrovascular disease: 3.0%
- Cardiac arrhythmia: 2.8%
- Urinary tract infections: 2.6%
99.5% of subjects in RUB 4 and 5 (high and very high) age >=50 years falls into one of the following ACG categories

<table>
<thead>
<tr>
<th>ACG</th>
<th>Average Cost in Euros population age &gt;=50</th>
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</thead>
<tbody>
<tr>
<td>4-5 Other ADG Combinations, Age &gt; 44, 2+ Major ADGs</td>
<td>6.696</td>
</tr>
<tr>
<td>6-9 Other ADG Combinations, Age &gt; 34, 3 Major ADGs</td>
<td>9.137</td>
</tr>
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<td>6-9 Other ADG Combinations, Age &gt; 34, 4+ Major ADGs</td>
<td>11.313</td>
</tr>
<tr>
<td>6-9 Other ADG Combinations, Age &gt; 34, 2 Major ADGs</td>
<td>13.261</td>
</tr>
<tr>
<td>10+ Other ADG Combinations, Age &gt; 17, 4+ Major ADGs</td>
<td>18.789</td>
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</table>
Dendrogramm for cluster analyses in hierarchical order of chronic diseases

Fonte ACG

(paper in progress, Dr Alessandra Buja)
Care integration and person centered approach
Stratifying the population and targeting High risk and emerging risk populations

- **5% high disease burden**
- **15% emerging risk**
- **claimers**
- **non-claimers**

**Emerging risk profile**

- **5% high disease burden**
- **15% emerging risk**
- **claimers**
- **non-claimers**

**Intensive intervention**

**Disease management**
What is needed is person-focused care over time, NOT disease-focused care.

When people (not diseases) are the focus of attention

- Outcomes are better
- Side effects are fewer
- Costs are lower
- Population health is greater

Hospitalization rate per 1,000 persons
ACG data. Year 2015. Regione Veneto
Care for multimorbidity demands higher integration

- Multidisciplinary teams manage all care in all key settings
- Common records used as part of joint practice/management
- Fund pooling for purchasing from both sides/new services

- Identify population ‘at risk’
- Discharge planning
- Routine, bidirectional reporting
- Case managers/linkage staff
- Defined payment arrangements

- Identify ‘emergent need’
- Refer and follow-up
- Provide information on request
- Understand who pays for what

Linkage → Coordination → Integration

Source: adapted from Leutz 1999 in Nolte & McKee (2008)
Ridesign models of care: innovative intervention

- Population focused but person centered
- Targeting high and emerging risk persons
- Evidence based
- Adapted from validated models
- Comprehensive
- Personalized
- Based on team work
- Granting continuity
### Case finding of patients with multimorbidity with ACG care management lists

<table>
<thead>
<tr>
<th>Patient Id</th>
<th>Age</th>
<th>RUB</th>
<th>Total Cost</th>
<th>Rescaled Total Cost Resource Index</th>
<th>Probability High Total Cost</th>
<th>Probability IP Hospitalization</th>
</tr>
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<tr>
<td>1002050</td>
<td>46</td>
<td>4</td>
<td>53,454,74</td>
<td>22,85</td>
<td>0,95</td>
<td>0,49</td>
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<tr>
<td>1014372</td>
<td>76</td>
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<td>38,975,03</td>
<td>18,97</td>
<td>0,95</td>
<td>0,60</td>
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<td>1003706</td>
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<td>4</td>
<td>14,089,49</td>
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<td>0,95</td>
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<td>0,95</td>
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<td>1005655</td>
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<td>53,476,02</td>
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<td>1016580</td>
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<td>0,95</td>
<td>0,47</td>
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Care Management Program

Patient's enrollment
Informed consent
Comprehensive assessment

Data from the initial assessment is compared with evidence based guidelines

Care Planning: Creation of the Care Plan

Translation into Action Plan for patients and caregivers

Follow up by phone calls, home visits and office visits

REVIEW
Integration of 40 care manager nurses, 32 GPs with their MH team 300 patients with multimorbidity followed up for two years

care management based on team work.
• The nurse follows a limited number of patients
• 20-40 patients from care management lists
• Approx. 20 patients per nurse.

Invitation and consent (enrollment by GP)
Home visits by the case manager nurse
Integrated Care Planning

• Patient preferences
• Care plan shared by GP and Case-manager Nurse
• Action Plan for patient and caregiver.
• Active monitoring with calls, home visits and outpatient visits.
• Team meeting and follow-ups
CARE MANAGEMENT PROGRAM

Cases compared with controls matched from the general population using the propensity score method.
6 MONTHS F-UP RESULTS

Outcomes: time to ER access and time to first hospitalization

<table>
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<tr>
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<th>RR ospedalizzazione</th>
<th>95% Confidence Limits</th>
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<tr>
<td>Si PCM vs No PCM</td>
<td>0.91</td>
<td>0.6 1.5</td>
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<th>RR Pronto Soccorso</th>
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<td>Si PCM vs No PCM</td>
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<td>0.7 1.4</td>
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<th>HR al primo ricovero</th>
<th>95% Confidence Limits</th>
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<tr>
<td>Si PCM vs No PCM</td>
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<td>0.6 1.2</td>
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</table>
PRELIMINARY RESULTS FROM THE EVALUATION QUESTIONNAIRE:
Recruited 300 patients

Satisfied or highly satisfied in participating in this program

- GP (72%)
- CM - Nurse (93%)
- Patient (97%)
S. Maria della Salute (Our Lady of Health) built as a votive offering for the city's deliverance from the plague in 1631.
mariachiara.corti@regione.veneto.it
Piano nazionale cronicità

EROGAZIONE DI INTERVENTI PERSONALIZZATI PER LA GESTIONE DEL PAZIENTE ATTRAVERSO IL PIANO DI CURA

MACRO ATTIVITÀ
- Il piano di cura personalizzato e l’assistenza proattiva
- Il “patto di cura” e l’empowerment
- Educazione terapeutica strutturata

OBIETTIVI
- Garantire un’assistenza sanitaria e sociosanitaria centrata sui bisogni e le caratteristiche personali e socio-ambientali del paziente
- Promuovere l’empowerment della persona con cronicità e migliorare la capacità di gestione della malattia nel proprio contesto familiare e sociale attraverso lo strumento della terapia educazionale

LINEE DI INTERVENTO PROPOSTE
1. sviluppare programmi di assistenza centrati sul paziente che tengano conto non solo della condizione clinica ma anche dei bisogni psicosociali
2. definire programmi di assistenza concepita e strutturata in una logica proattiva (‘Managed Care’), attraverso la definizione di un Piano di cura personalizzato, condiviso tra i vari attori e consolidato attraverso il ‘Patto di Cura’
3. sperimentare modalità di intervento che favoriscano lo sviluppo dell’ability to cope e lo sviluppo delle abilità di auto-cura
4. sostenere le attività di formazione e informazione dei pazienti e delle loro famiglie
5. promuovere l’adozione di modelli e di percorsi di educazione terapeutica strutturata che coinvolgano il paziente e i suoi caregiver
6. promuovere l’utilizzo di metodi per l’empowerment del paziente per formare e informare le persone con cronicità e tutti gli operatori sanitari e non sanitari coinvolti (es. modello Stanford)
7. diffondere la capacità di praticare educazione terapeutica efficace
8. promuovere la creazione di un “knowledge network”, tra le regioni, inteso come una rete di conoscenze sull’empowerment
9. favorire iniziative di ricerca e intervento, fondate su strategie validate, sulla valutazione dell’empowerment e sullo sviluppo di competenze degli operatori sanitari e delle comunità
10. individuare modelli di analisi e strumenti condivisi di rilevazione e monitoraggio dell’efficacia dell’empowerment del paziente

RISULTATI ATTESI
Miglioramento del livello di soddisfazione e della qualità della vita del paziente e del professionista e miglioramento dei risultati clinici.
Il framework del Population Health Management

Identificazione delle coorti

Segmentazione della pop.

Modelli deliberati di servizio per la presa in carico Piano di cure individuale

Valutazione degli outcome

Rivalutazione continua

(Fonte: Dutch Monitor, 2014)
Morbidity adjusted capitation?

Equality  -  Equity
Chronic patients and not acute patients are the main users of health care services

Il peso dei consumi per RUB in ogni anno d’età
Deaths may be attributed to chronic diseases, but people still get sick from acute diseases and acute exacerbations.