Distribution and impact of multimorbidity patterns in the general population: 

*National and International experiences*

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Contents

- Introduction
- Objectives
- Methods
- Results
- Discussion
- Conclusions

ARTICLES
Introduction
Population ageimg trends

By 2050 the number of persons aged 60 years and over will exceed the number of children for first time in history.

- Photo credit: DonkeyHotey / Foter / CC BY
Ageing trends in Spain

By 2050 more than 1/3 of the population will be over 60 years

- Photo credit: http://europa.eu
Ageing trends in Spain

Increase of life expectancy & decline in fertility rates

Life expectancy (years)

Life expectancy x 2

- Data extracted from: www.mortality.org (2014)
Implications of ageing trends

Success

but

Challenge

- Bigger retired community
- Less income taxes
- Sustainability of social system
- ↑ Health care costs
  - chronic conditions
Chronic conditions

Worldwide - 63% of the 57 million global deaths (2008)
Europe - 86% of deaths and 77% of the disease burden (2008)

“the rise in chronic conditions is a worldwide epidemic”

Consequences of chronic conditions

• **Admissions:** >50% of total admissions, longer stays
• **Expenditure:** 65% of total health expenditure
• **Disability & quality of life:** worse results
• **Dependency, carers, economic restraints**
• **Multimorbidity:** “co-occurrence of two or more diseases”

Multimorbidity

- Most elderly people: >2/3
- Poor clinical outcomes in these patients
  - Poor functional status
  - High mortality rates
- High use of healthcare resources
  - Complex coordination
  - Fragmentation of care
- Great expenditure: linear, near curvilinear
- Polypharmacy: adverse effects, drug interactions

Research on multimorbidity

- Publications results (title and abstract) on “multimorbidity” in pubmed. Source: http://mltrends.ogic.ca/
Study of multimorbidity

Need for a better description and understanding of MM

1 + 1 = 2?

Previous approaches
- Comorbidity
- Number of diseases
- Burden of disease
- Extended definitions

Fundamental issues to address multimorbidity:
- Interaction between chronic conditions
- How chronic conditions appear together

Multimorbidity patterns

Understanding multimorbidity patterns

There are groups of population suffering from the same co-occurring conditions

People with several CC

Process of classification

People classified by MP

**e.g.:**

<table>
<thead>
<tr>
<th></th>
<th>People suffering from hypertension, depression, arthritis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>YELLOW</strong></td>
<td>People suffering from diabetes, stroke, dementia, cancer</td>
</tr>
<tr>
<td><strong>BLUE</strong></td>
<td>People suffering from angina, anxiety</td>
</tr>
</tbody>
</table>
Needs in multimorbidity research

- In-depth studies of multimorbidity
- Representative population samples
- Standardized definitions of diseases
- Sound statistical methods
- Multimorbidity patterns
- Inclusion of mental conditions
  - Difficulty in diagnosis
  - Misconception of low prevalence
  - Controversy in terms of prevalence
  - Mental-physical comorbidity
  - Differences across age and gender

Vision impairment in the elderly

**Strong association** between aging and visual impairment

- ↑ risk of falling, ↑ disability
- ↑ healthcare utilization
- ↓ QOL & ↓ social participation
- ↑ mortality

⚠️ \( x2 \) number of 60+ with impaired vision (2006-2050)

≈ 80% of all visual impairment could be avoided or cured

Vision impairment and physical conditions

Chronic conditions and vision problems ➔ poor outcomes

**BUT little is known about their relationship**

**Documented association with a few conditions ➔** Ex: diabetes and ARMD

**Very limited information on most conditions and multimorbidity**

In the context of aging, it is necessary to elucidate this association

Vision impairment and mental disorders

- Scarce evidence
- Mixed results
- Limitations:
  - Sample size
  - Statistics
  - Non validated methods
  - Incomplete description of variables
  - Lack of consistency within a study
Vision impairment and cognition

The retina is part of the central nervous system

Possible association between ocular changes & cognitive decline

- Mixed results
- Sloan et al (2005): big changes
- Elliot et al (2013): near visual acuity
- Distance/near, objective/subjective

Disability and Quality of Life

Health outcomes which reflect the global health of the individual at various levels

**DISABILITY**
“umbrella term that reflects problems in bodily function, task performance and participation in life situations”

**QUALITY OF LIFE**
“an individual perception of their position in life... in relation to their goals, expectations, standards and concerns”

Disability and Quality of Life

Disability

- 3.8 millions
- 57% ♀>80+

Several indexes (ADL/IADL) (Katz, Walton...)

Global scores (WHODAS)

Quality of life

- Worse with age
- Variability in methodology
- Need to adapt tools for the elderly
- Short, concerns, capacity, comparable

Disability/QoL and chronic conditions

CC are one of the leading causes of preventable morbidity and disability

1. Individual assessment of some diseases with mixed results:
   - IADL/↓QoL: depression, arthritis, diabetes, asthma
   - Controversial results for most conditions: stroke, heart disease

2. Need to study combinations of CCs

3. Need to study cumulative effects of CCs

4. Clinical settings → general population

5. Gender differences to be studied

Quality of life → Active ageing

**Process** of optimizing opportunities for health, participation and security in order to enhance quality of life as people age.

Active ageing: successful, productive, healthy, positive, vital, optimal.

- http://www.who.int/ageing/active_ageing/en/
- Photo credit: Microsoft office 2014.
Active ageing: relevance of functional capacity

![Graph showing the relationship between age and functional capacity](source: Kalache & Kickbusch, 1997)

Objectives
Objectives

To explore:

1. the distribution of chronic conditions and **multimorbidity patterns**.
2. the association between physical conditions and mental disorders.

---

4. the individual and cumulative impact of chronic physical conditions on **visual impairment**.
5. the relationship between visual impairment and the presence of mental disorders and cognitive impairment.

---

6. the individual and cumulative impact of chronic physical and mental conditions on **QoL and disability** → general trends / across gender
Methods - Results - Discussion
Methodology: COURAGE project

OBJECTIVE: to study the determinants of health in the elderly

Finland
Poland
Spain

Demographic trends across Europe

n = 10800

Image credit: http://europa.eu
Description of the study - Spain

- Cross-sectional household survey on a national representative sample of the non-institutionalized adult population in Spain
- Multistage probability sampling
- Eligibility criteria: 18+; proxy (family/carers); test-retest; RR: 69.9%

n=4750

- 18-49 years
- 50-79 years
- 80+ years
## Description of the sample 50+ (n=3625)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>♂ 53,8 %</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>66,5 years</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;primary</td>
<td>32,6%</td>
</tr>
<tr>
<td>Primary</td>
<td>31,2 %</td>
</tr>
<tr>
<td>Secondary</td>
<td>25,5 %</td>
</tr>
<tr>
<td>University +:</td>
<td>10,7 %</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>8,5%</td>
</tr>
<tr>
<td>Married</td>
<td>62,1%</td>
</tr>
<tr>
<td>Divorced</td>
<td>6,9%</td>
</tr>
<tr>
<td>Widow:</td>
<td>22,5%</td>
</tr>
<tr>
<td><strong>Urbanicity</strong></td>
<td></td>
</tr>
<tr>
<td>Urban:</td>
<td>83,8%</td>
</tr>
<tr>
<td>Rural:</td>
<td>16,2%</td>
</tr>
<tr>
<td><strong>Work</strong></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>41,3%</td>
</tr>
<tr>
<td>Working</td>
<td>23,0%</td>
</tr>
<tr>
<td>Other</td>
<td>35,7%</td>
</tr>
<tr>
<td>*<em>Incomes</em></td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>22,0%</td>
</tr>
<tr>
<td>2nd</td>
<td>21,7%</td>
</tr>
<tr>
<td>3rd</td>
<td>21,6%</td>
</tr>
<tr>
<td>4th</td>
<td>21,7%</td>
</tr>
<tr>
<td>5th</td>
<td>13,0%</td>
</tr>
</tbody>
</table>

*quintiles from the total sample; 1<sup>st</sup> quintile: lowest; 5<sup>th</sup> highest.
Multimorbidity patterns

Multimorbidity Patterns in a National Representative Sample of the Spanish Adult Population

Noe Garin
Beatriz Olaya
Jaime Perales
Maria Victoria Moneta
Marta Miret
Jose Luis Ayuso-Mateos
Josep Maria Haro

Objectives

To explore:

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2. the association between physical conditions and mental disorders.

4. the individual and cumulative impact of chronic physical conditions on *visual impairment*.

5. the relationship between visual impairment and the presence of mental disorders and cognitive impairment.

6. the individual and cumulative impact of chronic physical and mental conditions on *QoL and disability* → general trends / across gender
Variables measured

Physical conditions

Self-report/algorithms:
- Arthritis
- Asthma
- COPD
- Angina
- Stroke
- Cataract
- Edentulism*
- Hypertension*
- Diabetes*

Mental disorders

CIDI questionnaire**:
- Depression (12-m)
- Anxiety (12-m)
  - Panic disorder
  - General anxiety disorder

Covariates

Questionnaire:
- Gender
- Age
- Education
- Marital status
- Urbanicity
- Income
- Employment

* Only self-report; **according to DSM-IV criteria
Prevalence of chronic conditions

Chronic conditions
- Highest prevalence: Hypertension, arthritis, cataract, depression
- Changes with age except anxiety
- ↑ in women for: depression, cataract, arthritis

Multimorbidity
- 20% of the overall adult population
- Increase with age up to: 67% women 65+, 53% men 65+
- Women > men

Number of chronic conditions
- Total number/physical/mental conditions: ↑ with age, ↑ in women
Multimorbidity patterns: factor analysis

- Tetrachoric correlation matrix
- Exploratory factor analysis
- Factors with eigenvalues > 1.0
- Three factors (patterns)
- Chronic conditions > 0.25
- KMO value = 0.70
  - Adequacy of the sample was considered acceptable
- All conditions related to at least one pattern.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angina</td>
<td>0.40</td>
<td>0.24</td>
<td>0.33</td>
</tr>
<tr>
<td>Cataracts</td>
<td>0.20</td>
<td>0.20</td>
<td>0.48</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.80</td>
<td>0.10</td>
<td>0.05</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.15</td>
<td>0.10</td>
<td>0.50</td>
</tr>
<tr>
<td>Edentulism</td>
<td>0.09</td>
<td>0.10</td>
<td>0.37</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.17</td>
<td>0.01</td>
<td>0.50</td>
</tr>
<tr>
<td>Arthritis</td>
<td>0.24</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Chronic Lung Disease</td>
<td>0.79</td>
<td>0.15</td>
<td>0.07</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.09</td>
<td>0.04</td>
<td>0.46</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.07</td>
<td>0.78</td>
<td>−0.01</td>
</tr>
<tr>
<td>Depression</td>
<td>0.24</td>
<td>0.76</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Factor 1 (cardio-respiratory); Factor 2 (mental-arthritis); Factor 3 (aggregate pattern).
Note = Factor scores ≥0.25 are highlighted.
doi:10.1371/journal.pone.0084794.t004
Multimorbidity patterns

Patterns: way that certain conditions tend to appear in the population

<table>
<thead>
<tr>
<th>Cardio-respiratory</th>
<th>angina, asthma, COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental-arthritis</td>
<td>arthritis, depression, anxiety</td>
</tr>
<tr>
<td>Aggregated pattern</td>
<td>angina, hypertension, stroke, diabetes, cataracts, edentulism, and arthritis</td>
</tr>
</tbody>
</table>

- Photo credit: Microsoft office. 2014
Multimorbidity patterns

First study showing multimorbidity patterns in the general population in Spain

1st pattern: CARDIO-RESPIRATORY

- Association between cardiac and pulmonary diseases in a few studies
- Airflow obstruction $\rightarrow$ higher risk of CV disease
- COPD patients $\rightarrow$ 42% of hospitalizations for CV causes
- Common risk factors vs common physiologic pathway (inflammatory?)
- Use of inhaled corticoids under study
- Diagnosis and management: some symptoms shared
- Need for further study of the asthma-COPD overlap

Multimorbidity patterns

2\textsuperscript{nd} pattern: MENTAL-ARTHRITIS

- Previous evidence on psychiatric comorbidity
- Psychiatric comorbidity: more negative impact in terms of health outcomes
- WMH surveys found that arthritis was related to mood/anxiety disorders
- Inflammatory pathway (IL-17) VS pain-mediated mental disorders

3\textsuperscript{rd} pattern: AGGREGATED PATTERN

- Broader pattern including seven conditions (hypertension, diabetes, cataract, stroke, edentulism, angina and arthritis)
- Complex causes may be involved: common risk factors, inflammatory pathways, metabolic syndrome, etc.

Physical & mental conditions: Binary logistic regressions

### Depression

<table>
<thead>
<tr>
<th>OR (95%CI)</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.01 (1.40,2.90)</td>
<td>Angina</td>
</tr>
<tr>
<td>1.62 (1.19,2.21)</td>
<td>Arthritis</td>
</tr>
<tr>
<td>1.86 (1.31,2.64)</td>
<td>Asthma</td>
</tr>
<tr>
<td>2.66 (1.84,3.86)</td>
<td>COPD</td>
</tr>
<tr>
<td>4.38 (2.31,8.33)</td>
<td>3+ CC</td>
</tr>
</tbody>
</table>

### Anxiety

<table>
<thead>
<tr>
<th>OR (95%CI)</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.39 (1.84,6.22)</td>
<td>Angina</td>
</tr>
<tr>
<td>5.23 (1.76,15.53)</td>
<td>3+ CC</td>
</tr>
</tbody>
</table>

Symptomatic conditions
(Chest pain, shortness of breath, joint pain)

Disability, isolation and frustration

Mental disorders

Multiple chronic conditions

National Multimorbidity Patterns
Global Multimorbidity Patterns
Global Multimorbidity Patterns: A Cross-Sectional, Population-Based, Multi-Country Study

Noé Garin¹,²,³,⁴, Ai Koyanagi³,⁴, Somnath Chatterji⁵, Stefanos Tyrovolas³,⁴, Beatriz Olaya³,⁴, Matilde Leonardî³,⁴, Elvira Lara³,⁴, Seppo Koskinen⁷, Beata Tobiasz-Adamczyk⁸, Jose Luis Ayuso-Mateos⁴,⁹,¹⁰ and Josep Maria Haro³,⁴

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Global Multimorbidity Patterns

**COURAGE study**
- Finland
- Poland
- Spain

+ **SAGE study**
- China
- Ghana
- India
- Mexico
- Russia
- South Africa
Conditions to be assessed

- Angina
- Anxiety (excluded)
- Arthritis
- Asthma
- Cataract
- COPD
- Cognitive impairment (new)
- Depression
- Diabetes
- Hypertension
- Obesity (new)
- Stroke
Multimorbidity prevalence among adults 50+
Multimorbidity prevalence among adults 50+
Comorbidity prevalence among adults 50+

<table>
<thead>
<tr>
<th>Condition</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>80-89</th>
<th>90+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angina</td>
<td>48</td>
<td>18</td>
<td>41</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Arthritis</td>
<td>27</td>
<td>12</td>
<td>35</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Asthma</td>
<td>37</td>
<td>45</td>
<td>47</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>Cataract</td>
<td>26</td>
<td>40</td>
<td>47</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>COPD</td>
<td>35</td>
<td>44</td>
<td>37</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>Cognitive imp.</td>
<td>19</td>
<td>36</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Depression</td>
<td>29</td>
<td>47</td>
<td>52</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Diabetes</td>
<td>27</td>
<td>42</td>
<td>12</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Edentulism</td>
<td>25</td>
<td>40</td>
<td>13</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Hypertension</td>
<td>21</td>
<td>35</td>
<td>8</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Obesity</td>
<td>28</td>
<td>43</td>
<td>10</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Stroke</td>
<td>35</td>
<td>44</td>
<td>14</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

Note: Numbers represent percentage of prevalence in each age group.
## Multimorbidity patterns: common behavior

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Number of countries</th>
<th>Countries</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio-Respiratory</td>
<td>7</td>
<td>China, Ghana, India, Mexico, Poland, South Africa, Spain</td>
<td>Angina, asthma, COPD, stroke&lt;sup&gt;G,M,P,SA&lt;/sup&gt;, depression&lt;sup&gt;C,I,M,P,SA,S&lt;/sup&gt;, arthritis&lt;sup&gt;C,M,P,SA,S&lt;/sup&gt;, cataract&lt;sup&gt;C,M,P&lt;/sup&gt;</td>
</tr>
<tr>
<td>Metabolic syndrome</td>
<td>8</td>
<td>China, Finland, Ghana, India, Poland, Russia, South Africa, Spain</td>
<td>Diabetes, obesity, hypertension, angina&lt;sup&gt;C,F,P,R,SA,S&lt;/sup&gt;, stroke&lt;sup&gt;C,G,R,SA,S&lt;/sup&gt;, cataract&lt;sup&gt;C,R,SA,S&lt;/sup&gt;, arthritis&lt;sup&gt;P,R,SA,S&lt;/sup&gt;, edentulism&lt;sup&gt;R,SA,S&lt;/sup&gt;, depression&lt;sup&gt;R&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mental – articular</td>
<td>3</td>
<td>China, Ghana, India</td>
<td>Arthritis, depression, stroke&lt;sup&gt;C&lt;/sup&gt;, cataract&lt;sup&gt;C,I&lt;/sup&gt;, angina&lt;sup&gt;I&lt;/sup&gt;</td>
</tr>
<tr>
<td>Respiratory</td>
<td>2</td>
<td>Finland, Russia</td>
<td>Asthma, COPD, cataract&lt;sup&gt;R&lt;/sup&gt;</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>Finland</td>
<td>Angina, cataract, diabetes, edentulism, hypertension, stroke</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>Mexico</td>
<td>Cataract, diabetes, stroke</td>
</tr>
</tbody>
</table>
Implications

Current guidelines focus on single diseases

Detection and understanding MP

1. Common physiological causes
2. Shared risk factors
3. Associated factors
4. Direct causation

Preventive measures
Comprehensive management
Adequate polipharmacy
Inclusion in trials

Physical-mental comorbidity

• Mental disorders should always be considered by practitioners: ↑ prevalence
• Symptomatic CCs / Multimorbidity patients: ↑ risk of suffering mental disorders
• SCREENING of mental disorders in certain patients
Vision and multimorbidity

Visual Impairment and Multimorbidity in a Representative Sample of the Spanish Population

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To explore:

1. the distribution of chronic conditions and **multimorbidity patterns**.
2. the association between physical conditions and mental disorders.
3. the individual and cumulative impact of chronic physical conditions on **visual impairment**.
4. the relationship between visual impairment and the presence of mental disorders and cognitive impairment.
5. the individual and cumulative impact of chronic physical and mental conditions on **QoL and disability** → general trends / across gender.
Variables measured

**Same variables**
- Physical conditions
- Mental disorders
- Covariates

**Visual assessment**

**Objective (VA):**
- Distance (3m)
- Near (40 cm)

**Subjective (questions):**
- Distance
- Near

**Cognitive functioning**

5 questionnaires:
- Learning
- Short-term memory
- Attention memory
- Working memory
- Language

**Global score**

VA: visual acuity

- Photo credit: Microsoft office. 2014
Results: Visual performance

Ageing $\rightarrow$ Poor visual performance

Women $\rightarrow$ Poor visual performance
### Results: Visual performance

- Binary logistic regressions for distance and near visual impairment.

<table>
<thead>
<tr>
<th>Condition</th>
<th>DVA (AOR)</th>
<th>NVA (AOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angina</td>
<td>1.12 (0.84-1.51)</td>
<td>1.07 (0.78-1.48)</td>
</tr>
<tr>
<td>Asthma</td>
<td>1.02 (0.72-1.44)</td>
<td>1.04 (0.70-1.54)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.87 (0.73-1.04)</td>
<td>1.10 (0.94-1.28)</td>
</tr>
<tr>
<td>Edentulism</td>
<td>1.12 (0.89-1.43)</td>
<td>1.16 (0.96-1.41)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.27 (1.01-1.60)</td>
<td>1.15 (0.86-1.52)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>1.79 (1.46-2.21)</td>
<td>1.16 (0.97-1.40)</td>
</tr>
<tr>
<td>Chronic Lung D</td>
<td>1.02 (0.74-1.42)</td>
<td>1.06 (0.70-1.60)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.59 (1.05-2.42)</td>
<td>3.01 (1.86-4.87)</td>
</tr>
<tr>
<td>Number of physical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conditions</td>
<td>1</td>
<td>1.32 (1.07-1.63)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.30 (1.00-1.67)</td>
</tr>
<tr>
<td></td>
<td>≥3</td>
<td>1.75 (1.38-2.23)</td>
</tr>
</tbody>
</table>

*DVA: distance visual assessment / NVA: near visual assessment

- Diabetes and Arthritis: ↓ Distance VA
- Stroke: ↓ Distance VA, ↓ Near VA
- Number of CC: ↓ Distance VA, ↓ Near VA
Number of CC increases the odds of visual impairment

First study to analyze this association

Unknown underlying mechanism:
Vascular, neurodegenerative, biochemical, inflammatory pathways...

BY ANALOGY WITH FRAILTY “cumulative effect”
Accumulation of deficits → vulnerability to adverse outcomes
Accumulation of CC → higher odds of visual impairment

Courts et al (2014) → The number of CC is strongly associated with visual impairment

More evidence is needed BUT monitoring of VA would be recommended in MM patients

Results: Vision and mental disorders

Binary logistic regressions for depression, anxiety and cognition

<table>
<thead>
<tr>
<th></th>
<th>Depression (AOR)</th>
<th>Anxiety (AOR)</th>
<th>Cognition (AOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance VA</td>
<td>1.25 (0.97-1.61)</td>
<td>0.74 (0.39-1.40)</td>
<td>1.27 (1.02-1.59)</td>
</tr>
<tr>
<td>Near VA</td>
<td>1.10 (0.78-1.53)</td>
<td>0.83 (0.43-1.64)</td>
<td>1.51 (1.28-1.85)</td>
</tr>
<tr>
<td>Subjective distance VA</td>
<td><strong>1.61 (1.14-2.27)</strong></td>
<td>1.47 (0.71-3.04)</td>
<td><strong>1.43 (1.00-2.06)</strong></td>
</tr>
<tr>
<td>Subjective near VA</td>
<td>1.48 (1.03-2.13)</td>
<td>0.27 (0.05-1.36)</td>
<td><strong>2.40 (1.52-3.71)</strong></td>
</tr>
</tbody>
</table>

- Distance/near subjective vision impairment $\rightarrow$ higher odds of depression
- For all types of vision impairment $\rightarrow$ higher odds of cognitive impairment
Mental disorders and vision

MENTAL HEALTH
- Controversial results in previous studies
- We tested both objective and subjective vision impairment
- Strong association subjective VI ↔ depression (not with anxiety)
- Self-experienced visual loss → isolation/disability → depression

COGNITIVE FUNCTIONING
- Mixed results in previous studies
- Simulated visual impairment → cognitive slowing in adults (elderly)
- Vision loss could lead to deprivation of sensory input → cerebral changes
- Loss of ganglion cells → impairment of the brain pathways (Alzheimer’s disease)
- Moreover, VI + Cognitive Impairment → higher disability

Implications

Physical conditions and vision

Eye-screening in increased risk of visual impairment:
- Specific conditions: stroke, diabetes, arthritis
- Multimorbidity

Further research may reveal common underlying factors or causality. Useful for:
- Prevention & management

Mental disorders and vision

People with vision impaired may be at higher risk of suffering mental disorders
Future studies should assess the benefits of psychological support in these patients

Cognitive decline and vision

Further study is needed to assess the usefulness of visual screening in cognitive decline
Impact of Multimorbidity on Disability and Quality of Life in the Spanish Older Population

Noe Garin
Beatriz Olaya
Maria Victoria Moneta
Marta Miret
Antonio Lobo
Jose Luis Ayuso-Mateos
Josep Maria Haro

Objectives

To explore:

1. the distribution of chronic conditions and **multimorbidity patterns**.
2. the association between physical conditions and mental disorders.

3. the individual and cumulative impact of chronic physical conditions on **visual impairment**.
4. the relationship between visual impairment and the presence of mental disorders and cognitive impairment.

6. the individual and cumulative impact of chronic physical and mental conditions on **QoL and disability** → general trends / across gender
**Variables measured**

### Same variables
- **Physical conditions**
- **Mental disorders**
- **Covariates**

*Only symptoms; **according to DSM-IV criteria*

### Disability
- **WHODAS-2.0**
  - Global measure
  - Validated
  - 12-item version

**Global score**
(Results: 0-100)

### Quality of life
- **WHOQOL-AGE**
  - WHOQOL version
  - Validated
  - For older adults
  - 13 questions

**Global score**
(Results: 0-100)

- Photo credit: Microsoft office. 2014
Impact of chronic conditions on QoL and disability

- **Highest impact on QoL and disability**
  - Depression
  - Anxiety
  - Stroke

- **Lowest impact on QoL and disability**
  - Hypertension

- Poorer results in QoL and disability
  - $↑$ Number of CC
Results of multiple linear regressions

All CCs BUT hypertension $\rightarrow$ poor results in QoL/disability

<table>
<thead>
<tr>
<th>Highest impact</th>
<th>depression, anxiety, stroke</th>
<th>mental, stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate impact</td>
<td>cataracts, COPD, angina, asthma</td>
<td>symptomatic</td>
</tr>
<tr>
<td>Lowest impact</td>
<td>diabetes, edentulism</td>
<td>$\approx$ asymptomatic</td>
</tr>
<tr>
<td>No impact</td>
<td>hypertension</td>
<td>asymptomatic</td>
</tr>
</tbody>
</table>

Specific combinations

Diabetes + cataracts $\rightarrow$ $\uparrow$ Disability and $\downarrow$ Quality of life
Results of linear regressions

Cumulative impact of chronic conditions

Sharp, continuous change in QoL/disability with ↑ CCs
## Gender trends

<table>
<thead>
<tr>
<th>Descriptive results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women $\rightarrow$ ↓ disability/QoL for most conditions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>“General” regressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender $\rightarrow$ moderate-small size effect</td>
</tr>
</tbody>
</table>

### Separate regressions per gender: similar trends **BUT**

<table>
<thead>
<tr>
<th>QoL</th>
<th>Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women (anxiety, angina)</td>
<td>Women (anxiety, cataract, diabetes)</td>
</tr>
<tr>
<td>Men (asthma, edentulism)</td>
<td>Men (asthma)</td>
</tr>
</tbody>
</table>

For specific conditions there may be a different behavior

Being single resulted in poorer results only in men
Implications

Prevention of CCs

↑ Disability  ↓ QoL  Preventable Chronic conditions  Preventive measures for CCs may impact on disability/QoL

Expenditures: 97% treatment – 3% prevention

Early management of modifiable/correctable CCs

↑ Disability  ↓ QoL  Cataract, edentulism, ostearthritis  Measures for CCs may impact on disability/QoL

Prioritize actions in those CCs with poorer outcomes

Interventions (e.g.: strength training) to prevent further disability, psychological support
Active ageing ≈ Quality of Life
Active ageing

Process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age.

- http://www.who.int/ageing/active_ageing/en/
- Photo credit: Microsoft image
Active ageing in Europe

Factors associated with active aging in Finland, Poland, and Spain

Jaime Perales,1 Steven Martin,2 Jose Luis Ayuso-Mateos,3 Somnath Chatterji,4 Noe Garin,1 Seppo Koskinen,5 Matilde Leonardi,6 Marta Miret,7,8 Victoria Moneta,1 Beatriz Olaya,1 Beata Tobiasz-Adamczyk9 and Josep Maria Haro1,7

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3 Department of Psychiatry, Universidad Autónoma de Madrid, Centro de Investigación Biomédica en Red de Salud Mental (CIBERSAM), Instituto de Investigación Sanitaria Princesa (IPS), Hospital Universitario la Princesa, Madrid, Spain
4 Department of Health Statistics and Information Systems, World Health Organization, Geneva, Switzerland
5 National Institute for Health and Welfare, Helsinki, Finland
6 Department of Neurology, Public Health and Disability, Italian National Neurological Institute “Carlo Besta” Foundation IRCGS (Istituto di ricovero e cura a carattere scientifico), Milan, Italy
7 Instituto de Salud Carlos III, Centro de Investigación Biomédica en Red de Salud Mental, CIBERSAM, Madrid, Spain
8 Department of Psychiatry, Universidad Autónoma de Madrid, Hospital Universitario de La Princesa, Instituto de Investigación Sanitaria Princesa (IPS), Madrid, Spain
9 Chair of Epidemiology and Preventive Medicine, Department of Medical Sociology, Jagiellonian University Medical College, Krakow, Poland
Conceptualization of active ageing

**Biomedical**
Chronic conditions, disability, cognition, depression, smoking, alcohol, physical activity.

**Psychosocial**
Social participation, number of social contacts, social support, quality of life, ability to cope with problems.

**Complete model**
- Biomedical
- Psychosocial
- External safety: environmental safety, income, etc.
Active ageing: controversies

- Multiple definitions
- Variety of models: focused on several domains
- Cut points: Lack of standardization
- Artificial division among active/non active:
  - Usefulness of a continuous variable?
- Variability across studies: 0,4 – 95%
Objectives & methodology

Determining the degree of active ageing and its correlations across countries (Finland, Poland, Spain)

- COURAGE study: Finland, Poland, Spain.
- Adults 50+
- Active ageing – 4 models:
  - Biomedical (2)
  - Psychosocial (1)
  - Expanded model “complete model”
## Associations: models & sociodemographic variables

<table>
<thead>
<tr>
<th>Country</th>
<th>Rowe &amp; Kahn’s Range (0-5) Coefficient (95% CI)</th>
<th>Biomedical Range (0-7) Coefficient (95% CI)</th>
<th>Psychosocial Range (0-6) Coefficient (95% CI)</th>
<th>Complete Range (0-15) Coefficient (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poland (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spain</td>
<td>0.42 (0.28; 0.56)*</td>
<td>0.34 (0.20; 0.48)*</td>
<td>0.86 (0.69; 1.03)*</td>
<td>1.35 (1.07; 1.63)*</td>
</tr>
<tr>
<td>Finland</td>
<td>0.97 (0.87; 1.08)*</td>
<td>-</td>
<td>0.86 (0.69; 1.03)*</td>
<td>2.42 (2.18; 2.65)*</td>
</tr>
<tr>
<td>Gender</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Women (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Men</td>
<td>0.22 (0.15; 0.29)*</td>
<td>-</td>
<td>0.36 (0.18; 0.55)*</td>
<td>-</td>
</tr>
<tr>
<td>Age</td>
<td>-0.05 (-0.05; -0.02)*</td>
<td>-</td>
<td>-0.05 (-0.06; -0.04)*</td>
<td>-</td>
</tr>
<tr>
<td>Highest education level completed</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>College / university/postgraduate (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High school</td>
<td>-0.29 (-0.40; -0.17)*</td>
<td>-</td>
<td>-0.64 (-0.84; -0.44)</td>
<td>-</td>
</tr>
<tr>
<td>Secondary school</td>
<td>-0.44 (-0.54; -0.33)*</td>
<td>-</td>
<td>-1.00 (-1.22; -0.79)</td>
<td>-</td>
</tr>
<tr>
<td>Primary school</td>
<td>-0.66 (-0.79; -0.52)*</td>
<td>-</td>
<td>-1.29 (-1.62; -0.97)</td>
<td>-</td>
</tr>
<tr>
<td>Never/incomplete primary school</td>
<td>-0.95 (-1.11; -0.79)*</td>
<td>-0.50 (-0.65; -0.35)</td>
<td>-1.45 (-1.82; -1.09)</td>
<td>-</td>
</tr>
<tr>
<td>Occupation (ISCO 08) b</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Skill level 1 (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Skill level 2</td>
<td>0.21 (0.06; 0.36)*</td>
<td>0.05 (-0.10; 0.19)</td>
<td>0.52 (0.27; 0.78)</td>
<td>-</td>
</tr>
<tr>
<td>Skill level 3</td>
<td>0.48 (0.32; 0.64)*</td>
<td>0.21 (0.05; 0.37)</td>
<td>1.21 (0.90; 1.53)</td>
<td>-</td>
</tr>
<tr>
<td>Never worked</td>
<td>-0.38 (-0.54; -0.22)*</td>
<td>-0.10 (-0.26; -0.06)</td>
<td>0.31 (-0.32; 0.31)</td>
<td>-</td>
</tr>
<tr>
<td>Marital status</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Married or in partnership (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Widowed</td>
<td>-0.71 (-0.81; -0.62)*</td>
<td>-0.46 (-0.55; -0.36)*</td>
<td>-0.40 (-0.49; -0.31)*</td>
<td>-1.30 (-1.51; -1.08)</td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>0.05 (-0.09; 0.19)</td>
<td>-0.19 (-0.35; -0.02)*</td>
<td>-0.76 (-1.11; -0.40)*</td>
<td>-</td>
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<tr>
<td>Never married</td>
<td>-0.01 (-0.16; 0.13)</td>
<td>-0.02 (-0.14; 0.11)</td>
<td>-0.54 (-0.90; -0.17)</td>
<td>-</td>
</tr>
<tr>
<td>Urbanicity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rural (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urban</td>
<td>0.18 (0.00; 0.36)</td>
<td>0.19 (0.04; 0.34)*</td>
<td>0.17 (-0.06; 0.40)</td>
<td>0.30 (-0.13; 0.73)</td>
</tr>
</tbody>
</table>
## Associations: models & sociodemographic variables

<table>
<thead>
<tr>
<th></th>
<th>Rowe &amp; Kahn</th>
<th>Biomedical</th>
<th>Psychosocial</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
<td>F &gt; E &gt; P</td>
<td>F &gt; E &gt; P</td>
<td>F &gt; E &gt; P</td>
<td>F &gt; E &gt; P</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Male &gt; Female</td>
<td>Female &gt; Male</td>
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<td></td>
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<tr>
<td><strong>Age</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Civil status</strong></td>
<td>Married+</td>
<td>Married +</td>
<td>Married +</td>
<td>Married +</td>
</tr>
<tr>
<td><strong>Urbanicity</strong></td>
<td></td>
<td>Urban +</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Complete model: results by country

Spain  2  9.8 (9.6-10.0)
Finland  1  10.9 (10.7-11.1)
Poland  3  8.6 (8.4-8.7)

Range (0-15)
## Complete model: results by country

<table>
<thead>
<tr>
<th></th>
<th>Poland</th>
<th>Spain</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>Male &gt; Female</td>
<td>Male &gt; Female</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Civil status</strong></td>
<td>Married +</td>
<td>Married +</td>
<td>Married +</td>
</tr>
<tr>
<td><strong>Urbanicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Limitations
Limitations

1. Cross-sectional results
2. Cohorts effects
3. Selection of a limited number of CC: ↓ MM prevalence
4. Other CCs: anemia, malignancies, heart failure, etc.
5. Self-report nature of diagnose BUT acceptable correlations
6. No consideration of: progression and severity of conditions
7. Combinations assessed in QoL and disability: more frequent
Conclusions
Conclusions 1/3

Population is ageing (and will keep on ageing)

CCs appear in certain multimorbidity patterns

Most patterns seem to be similar globally
Conclusions 2/3

Visual impairment & specific conditions* are associated

Great association between MM and visual impairment

Subjective vision is associated with depression

Vision impairment is clearly associated with cognition

* stroke, arthritis, diabetes
Conclusions 3/3

All CCs but hypertension impact on QoL/disability individually

Multimorbidity impacts greatly on QoL / disability
Any questions?