Original article

Burden of disease assessment with summary measures of population health for the Region of Valencia, Spain: a population-based study

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ABSTRACT

Background and objective: An important input to decision-making and health planning is a consistent and comparative description of the population health status. The purpose of this study was to describe the burden of disease in the Region of Valencia (Spain).

Material and methods: Disability-adjusted life years (DALYs) were calculated and divided into years of life lost (YLLs) and years lived with disability (YLDs). Using death registry data and Valencian population estimates in 2008, we calculated the number of deaths and YLLs. YLDs were based on age- and sex-specific data for countries of the EURO-A subregional level (which includes the Region of Valencia) from the Global Burden of Disease study. The results were stratified by age group, sex and underlying cause of death. The DALY values were used to rank the leading conditions of disease burden.

Results: In 2008, the total number of DALYs lost was about 551 thousands (53% in men). The main categories of DALYs lost were neuropsychiatric conditions (30%; 167 thousands), malignant tumors (15%; 85 thousands), cardiovascular diseases (13%; 72 thousands) and sense organ diseases (8%; 46 thousands). Depression (8% of DALYs; 47 thousands), dementias (8%; 42 thousands), ischaemic heart disease (5%; 27 thousands), hearing loss (4%; 22 thousands), stroke (4%; 20 thousands) and lung cancer (3%; 19 thousands) were the leading specific causes of disease burden.

Conclusions: We provide for the first time ever information on the burden of disease in the Valencian population. At this local level, the use of DALYs can help to monitor the population health status and guide the debates on rational priority-setting.

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Evaluación de la carga de enfermedad con medidas sintéticas de salud de la población para la Comunidad Valenciana, España: un estudio de base poblacional

RESUMEN

Fundamento y objetivo: La descripción consistente y comparativa del estado de salud de la población es importante para la toma de decisiones y la planificación sanitaria. El objetivo de este estudio fue describir la carga de enfermedad en la Comunidad Valenciana.

Material y métodos: Se calcularon los años de vida ajustados por discapacidad (AVAD), que se dividen en años de vida perdidos (AVP) y años vividos con discapacidad (AVD). Utilizando información procedente del registro de mortalidad y de las estimaciones de la población valenciana en el año 2008, se calculó el número de muertes y AVD. Los AVD se basan en datos específicos por sexo y edad de los países de la sub-región EURO-A (que incluye a la Comunidad Valenciana) del estudio de Carga Global de Enfermedad. Los resultados fueron estratificados por grupos de edad, sexo y causa de muerte. Los valores de AVAD se utilizaron para clasificar las condiciones que producen mayor carga de enfermedad.

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Results: In 2008, they were 551 million DALYs (53% in children). The leading causes of DALYs were neuropsychiatric disorders (283 million [30% of total DALYs]), followed by injuries (187 million [14%]), neoplasms (187 million [14%]), cardiovascular diseases (172 million [13%]), liver diseases (172 million [13%]), and cerebrovascular diseases (172 million [13%]).

Conclusions: We propose a framework for prioritizing DALYs and mortality burden in the Valencian Region. The framework is based on a comprehensive national database and a multidisciplinary approach, including data from administrative records, vital statistics, and health care expenditures. DALYs can be calculated as the sum of the years of life lost (YLLs) due to premature death and the years lost due to disability (YLDs).

The general equation for DALYs is: DALYs = YLLs + YLDs. Full equations for YLLs and YLDs are shown below:

\[ \text{DALYs} = \frac{K C e^{a}}{(r + \beta) \left(e^{-r(\beta + a) - \left[-(r + \beta)(L + a) - 1\right]} - e^{-r(\beta + a)[-(r + \beta)(a - 1)]} + \frac{(1 - K)}{r(1 - e^{-r})}\right)} \]

where, \( r \): discount rate (for health gain in the future); \( K \): standard age-weighting modulation factor, a parameter that allows a range of age-weighting to be used from \( K = 0 \) (totally uniform) to \( K = 1 \) (maximum ununiformity); \( C \): constant = 0.1658; \( \beta \): parameter from the age weighting function = 0.04; \( L \): years of life lost at age \( a \); \( a \): onset of disease year; \( e \): constant = 2.71; \( I \): number of incident cases; and \( D \): disability weights (ranging from 1 – death to 0 – perfect health).

The method for calculating the burden of disease and injury involved the following steps:

(a) According to the GBD methods, we took all diseases and injuries grouped in accordance with the International Classification of Diseases 10th Revision (ICD-10 codes) and we reclassified them into the following levels of the Global Burden of Disease classification: 3 broad cause groups and 21 disease categories and 76 selected disease subcategories.

(b) Data estimates on 2008 mid-year population measuring age- and sex-structure of the resident population of the Valencia Region were obtained from the National Statistics Institute (INE).

(c) Data on mortality for the year 2008 were obtained directly from the anonymized official microdata files of the INE. Deaths records are based on death certificates completed shortly after the time of death and these data are recognized of high-quality for being used for research and administrative purposes. YLLs were calculated multiplying the number of deaths by age and sex by the standard life expectancy at the time of death.

(d) The YLDs estimates were based on the GBD analyses of incidence, duration and severity of conditions for the relevant epidemiological subregion EURO-A (which includes the Region of Valencia and other geographic areas with very low mortality). For specific disease causes where mortality was responsible for a significant proportion of the total burden (YLD/YLL ratio less than 10), EURO-A subregional estimates of YLD/YLL ratios by age and sex together with local estimates of YLLs were used to estimate YLDs at a local-level. In the case of...
low-mortality diseases (YLD/YLL ratio more than 10), local YLDs were computed by multiplying the EURO-A YLDs rates by the Valencian population (as of 1 July 2008) by sex and age group.

(e) Standard life expectancies by age group obtained from the Princeton Model Life Table with Level West 26 modified (82.5 years of life expectancy for women and 80 years of life expectancy for men), parameters relating to discounting \( (r = 3\%\) and age weights \( (K = 1)\) were applied to DALYs formulae.6

Statistical analysis

A descriptive analysis was performed using tabulated frequencies and percentage counts. Burden of disease estimates were performed using GesMor,24 a computer software tool developed by the International Health Department of the Carlos III Institute of Health specifically to calculate DALYs, and Epidat 4 software. In this study, correlation and linear regression models were fitted to determine the patterns of mortality and morbidity due to each disease and injury, and to identify relationships between fatalities (deaths), premature deaths (YLL), and disabilities (YLDs) with disease burden (DALYs). The level of statistical significance was set at \( P \) values less than 0.05.

Results

In 2008, the total number of DALYs lost was about 551,417. This figure represents 111.4 years of ill-health and early deaths were lost among each 1000 people. From the total number of DALYs, 41.6% were due to premature deaths (229,382 YLLs) and 58.4% were due to disability (322,035 YLDs). Non-communicable diseases (group II) explained 89.2% of the total DALYs, accidents and injuries (group III) for 5.6%, and communicable, maternal, perinatal, and nutritional conditions (group I) accounted the remaining 5.3%. Table 1 shows disease groups and categories of crude mortality and DALYs with corresponding YLLs, YLDs and YLDs/DALYs ratios for all ages by sex. The main categories of DALYs lost were neuropsychiatric conditions (30.3% of total DALYs), malignant tumors (15.4%), cardiovascular diseases (13.1%) and sense organ diseases (8.3%). These four disease categories account for 67.2% of the total DALYs lost in the Valencian population (370.6 thousands of DALYs). Fig. 1 shows DALY rates per 100,000 people by sex, and disease categories.

Table 2 shows the leading subcategories of DALYs and crude deaths with corresponding YLLs/DALYs ratios by sex. Overall, unipolar depression (8.5% of DALYs), Alzheimer’s and other dementias (7.6%), ischaemic heart disease (4.9%), hearing loss (4.0%), stroke (3.6%) and lung cancer (3.5%) were the leading specific causes of disease burden. For men, ischaemic heart disease (6.3% of DALYs), unipolar depression (5.6%) and lung cancer (5.4%) ranked first, second and third, respectively, followed by Alzheimer’s and other dementias (5.0%) and alcohol use disorders (4.9%). Unipolar depression (11.8%), Alzheimer’s and other dementias (10.7%) and hearing loss (4.2%) were the first, second and third contributors for females, followed by stroke (3.6%) and ischaemic heart disease (3.3%) (see Table 2).

Fig. 2 shows the distribution of DALY rates per 100,000 people by age and sex. In terms of age, the number of DALYs gradually increased with age and 27.3% of all DALYs occurred among people aged over 70 years. DALYs for children aged 0–14 years were about 229,976 representing 5.4% of the total burden. Perinatal conditions (6.7 thousands of DALYs), neuropsychiatric conditions (6.6 thousands) and congenital anomalies (4.6 thousands) dominated the burden of disease in children. Between the ages of 15–29 years (86.6 thousands representing 15.7% of DALYs) and 30–44 years (100.4 thousands representing 18.2% of DALYs), neuropsychiatric conditions were the leading cause of DALYs, accounting for 55.9 thousands and 37.1 thousands, respectively. From 45 to 59 years, malignant tumors (26.9 thousands; 25.2% of DALYs at this age) assumed importance, particularly in the case of lung, breast cancer

<table>
<thead>
<tr>
<th>Disease groups and categories (ICD-10 codes)</th>
<th>Deaths in thousands (%)</th>
<th>DALYs in thousands (%)</th>
<th>YLLs in thousands (%)</th>
<th>YLDs in thousands (%)</th>
<th>YLDs/DALYs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>2.1 (5.3)</td>
<td>29 (5.3)</td>
<td>164 (7.1)</td>
<td>127 (3.9)</td>
<td>43.6</td>
</tr>
<tr>
<td>Respiratory infections</td>
<td>0.8 (2.2)</td>
<td>12.5 (2.3)</td>
<td>7.5 (3.3)</td>
<td>4.9 (3.9)</td>
<td>39.5</td>
</tr>
<tr>
<td>Maternal conditions</td>
<td>1.1 (2.6)</td>
<td>4.7 (0.9)</td>
<td>4.1 (1.8)</td>
<td>0.6 (0.2)</td>
<td>12.9</td>
</tr>
<tr>
<td>Maternal conditions</td>
<td>0.0 (0.0)</td>
<td>0.0 (0.0)</td>
<td>0.0 (0.0)</td>
<td>0.0 (0.0)</td>
<td>0.0</td>
</tr>
<tr>
<td>Perinatal conditions</td>
<td>0.1 (0.3)</td>
<td>6.8 (1.2)</td>
<td>4.6 (2.0)</td>
<td>2.2 (0.7)</td>
<td>32.7</td>
</tr>
<tr>
<td>Nutritional deficiencies</td>
<td>0.0 (0.1)</td>
<td>0.0 (0.0)</td>
<td>0.1 (0.1)</td>
<td>2.9 (0.9)</td>
<td>95.0</td>
</tr>
<tr>
<td><strong>Group II</strong></td>
<td>36.5 (91.1)</td>
<td>491.6 (89.2)</td>
<td>190.2 (82.9)</td>
<td>301.4 (93.6)</td>
<td>61.3</td>
</tr>
<tr>
<td>Malignant tumors</td>
<td>10.5 (26.2)</td>
<td>84.9 (15.4)</td>
<td>76.7 (33.4)</td>
<td>8.3 (2.6)</td>
<td>9.7</td>
</tr>
<tr>
<td>Other (benign) tumors</td>
<td>0.3 (0.8)</td>
<td>2.1 (0.4)</td>
<td>2.1 (0.9)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1.1 (2.8)</td>
<td>9.5 (1.7)</td>
<td>4.1 (1.8)</td>
<td>0.4 (1.7)</td>
<td>56.5</td>
</tr>
<tr>
<td>Blood and endocrine disorders</td>
<td>0.3 (0.9)</td>
<td>8.5 (1.5)</td>
<td>2.6 (1.1)</td>
<td>5.9 (1.8)</td>
<td>69.4</td>
</tr>
<tr>
<td>Neuropsychiatric conditions</td>
<td>3.4 (8.6)</td>
<td>167.1 (30.3)</td>
<td>12.9 (5.6)</td>
<td>154.2 (47.9)</td>
<td>92.3</td>
</tr>
<tr>
<td>Sense organ diseases</td>
<td>0.0 (0.0)</td>
<td>46.0 (8.4)</td>
<td>0.0 (0.0)</td>
<td>46.0 (14.3)</td>
<td>99.9</td>
</tr>
<tr>
<td>Cardiovascular diseases</td>
<td>13.6 (34.0)</td>
<td>72.4 (13.1)</td>
<td>57.5 (25.1)</td>
<td>14.9 (4.6)</td>
<td>20.6</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>3.2 (8.1)</td>
<td>35.1 (6.4)</td>
<td>13.0 (5.7)</td>
<td>22.1 (6.9)</td>
<td>63.0</td>
</tr>
<tr>
<td>Digestive diseases</td>
<td>2.1 (5.2)</td>
<td>23.3 (4.2)</td>
<td>13.2 (5.8)</td>
<td>10.0 (3.1)</td>
<td>43.1</td>
</tr>
<tr>
<td>Genitourinary diseases</td>
<td>1.2 (2.9)</td>
<td>5.9 (1.1)</td>
<td>3.9 (1.7)</td>
<td>2.0 (0.6)</td>
<td>35.1</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>0.2 (0.4)</td>
<td>1.7 (0.3)</td>
<td>0.5 (0.2)</td>
<td>1.2 (0.4)</td>
<td>68.6</td>
</tr>
<tr>
<td>Musculoskeletal diseases</td>
<td>0.3 (0.8)</td>
<td>25.9 (4.7)</td>
<td>1.0 (0.4)</td>
<td>24.8 (7.7)</td>
<td>95.9</td>
</tr>
<tr>
<td>Congenital anomalies</td>
<td>0.0 (0.2)</td>
<td>0.9 (0.0)</td>
<td>2.5 (1.1)</td>
<td>5.0 (0.8)</td>
<td>49.5</td>
</tr>
<tr>
<td>Oral conditions</td>
<td>0.0 (0.0)</td>
<td>3.9 (0.7)</td>
<td>0.0 (0.0)</td>
<td>3.9 (1.2)</td>
<td>99.9</td>
</tr>
<tr>
<td><strong>Group III</strong></td>
<td>1.4 (3.6)</td>
<td>30.7 (5.6)</td>
<td>22.8 (9.9)</td>
<td>7.9 (2.5)</td>
<td>25.8</td>
</tr>
<tr>
<td>Unintentional injuries</td>
<td>1.0 (2.6)</td>
<td>22.7 (4.1)</td>
<td>15.5 (6.8)</td>
<td>7.2 (2.2)</td>
<td>31.7</td>
</tr>
<tr>
<td>Intentional injuries</td>
<td>0.4 (1.1)</td>
<td>8.0 (1.5)</td>
<td>7.3 (3.2)</td>
<td>0.7 (0.2)</td>
<td>9.0</td>
</tr>
<tr>
<td><strong>Total from all causes</strong></td>
<td>40.1 (100)</td>
<td>551.4 (100)</td>
<td>229.4 (100)</td>
<td>322.0 (100)</td>
<td>58.4</td>
</tr>
</tbody>
</table>

Group I: Communicable, maternal, perinatal, and nutritional conditions; Group II: Noncommunicable diseases; Group III: Accidents and injuries.

DALYs: disability-adjusted life years; YLLs: years of life lost; YLDs: years lived with disability.
and colorectal cancer. The 60–69 age group was a transition group, in which the most noteworthy feature was musculoskeletal diseases in women. Among people aged over 70 years, Alzheimer’s and other dementias peaked (35.4 thousands of DALYs), chronic obstructive pulmonary disease became prominent in men, and ischaemic heart disease assumed great importance across the sexes.

Fig. 3 shows the relationship between crude mortality, YLLs, YLDs and DALYs for 97 observations (21 disease categories and 76 subcategories). Malignant tumors and cardiovascular diseases are represented similarly by crude mortality and YLLs. Conversely, the plots show the outliers clearly for some conditions where the mortality component are rather less than that is suggested by the burden of disease as measured by DALYs (e.g. neuropsychiatric conditions, sense organ diseases or musculoskeletal diseases). On the other hand, the Spearman’s-rank correlation coefficients were found to be positive and statistically significant for all measures. The plots, for crude mortality (correlation coefficient: 0.428; P...
Table 2
Leading causes of DALYs and deaths with corresponding YLDs/DALYs ratios by sex. Region of Valencia, 2008.

<table>
<thead>
<tr>
<th>Disease conditions</th>
<th>Deaths in thousands (%)</th>
<th>DALYs in thousands (%)</th>
<th>YLDs/DALYs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Both sexes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Unipolar depression</td>
<td>0.0 (0.0)</td>
<td>46.8 (8.5)</td>
<td>99.9</td>
</tr>
<tr>
<td>2. Alzheimer’s and other dementias</td>
<td>2.7 (6.7)</td>
<td>42.0 (7.6)</td>
<td>83.4</td>
</tr>
<tr>
<td>3. Ischaemic heart disease</td>
<td>4.6 (11.4)</td>
<td>27.1 (4.9)</td>
<td>15.7</td>
</tr>
<tr>
<td>4. Hearing loss, adult onset</td>
<td>0.0 (0.0)</td>
<td>22.2 (4.0)</td>
<td>100.0</td>
</tr>
<tr>
<td>5. Stroke</td>
<td>3.5 (8.8)</td>
<td>19.9 (3.6)</td>
<td>30.5</td>
</tr>
<tr>
<td>6. Lung cancer</td>
<td>2.4 (5.9)</td>
<td>19.4 (3.5)</td>
<td>2.9</td>
</tr>
<tr>
<td>7. Alcohol use disorders</td>
<td>0.0 (0.1)</td>
<td>17.4 (3.2)</td>
<td>97.8</td>
</tr>
<tr>
<td>8. Refractive errors</td>
<td>0.0 (0.0)</td>
<td>14.4 (2.6)</td>
<td>100.0</td>
</tr>
<tr>
<td>9. Osteoarthritis</td>
<td>0.0 (0.0)</td>
<td>13.3 (2.5)</td>
<td>99.7</td>
</tr>
<tr>
<td>10. Chronic obstructive pulmonary disease</td>
<td>1.7 (4.2)</td>
<td>12.3 (2.2)</td>
<td>49.9</td>
</tr>
<tr>
<td>Total from the top 10 causes</td>
<td>14.9 (37.2)</td>
<td>235.3 (42.7)</td>
<td>30.1</td>
</tr>
<tr>
<td>Total from all causes</td>
<td>40.1 (100)</td>
<td>551.4 (100)</td>
<td>58.4</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ischaemic heart disease</td>
<td>2.5 (12.1)</td>
<td>18.5 (6.3)</td>
<td>15.6</td>
</tr>
<tr>
<td>2. Unipolar depression</td>
<td>0.0 (0.0)</td>
<td>16.4 (5.6)</td>
<td>99.9</td>
</tr>
<tr>
<td>3. Lung cancer</td>
<td>2.0 (9.7)</td>
<td>15.9 (5.4)</td>
<td>2.9</td>
</tr>
<tr>
<td>4. Alzheimer’s and other dementias</td>
<td>0.8 (4.2)</td>
<td>14.6 (5.0)</td>
<td>15.9</td>
</tr>
<tr>
<td>5. Alcohol use disorders</td>
<td>0.0 (0.1)</td>
<td>14.3 (4.9)</td>
<td>97.6</td>
</tr>
<tr>
<td>6. Hearing loss, adult onset</td>
<td>0.0 (0.0)</td>
<td>11.4 (3.9)</td>
<td>100.0</td>
</tr>
<tr>
<td>7. Stroke</td>
<td>1.5 (7.1)</td>
<td>10.4 (3.6)</td>
<td>32.6</td>
</tr>
<tr>
<td>8. Chronic obstructive pulmonary disease</td>
<td>1.3 (6.1)</td>
<td>9.6 (3.3)</td>
<td>50.9</td>
</tr>
<tr>
<td>9. Road traffic accidents</td>
<td>0.3 (1.5)</td>
<td>7.3 (2.5)</td>
<td>16.7</td>
</tr>
<tr>
<td>10. Refractive errors</td>
<td>0.0 (0.0)</td>
<td>7.0 (2.4)</td>
<td>100.0</td>
</tr>
<tr>
<td>Total from the top 10 causes</td>
<td>8.5 (40.8)</td>
<td>125.5 (42.7)</td>
<td>36.4</td>
</tr>
<tr>
<td>Total from all causes</td>
<td>20.9 (100)</td>
<td>293.9 (100)</td>
<td>52.2</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Unipolar depression</td>
<td>0.0 (0.0)</td>
<td>30.4 (11.8)</td>
<td>99.9</td>
</tr>
<tr>
<td>2. Alzheimer’s and other dementias</td>
<td>1.8 (9.4)</td>
<td>27.4 (10.7)</td>
<td>83.7</td>
</tr>
<tr>
<td>3. Hearing loss, adult onset</td>
<td>0.0 (0.0)</td>
<td>10.8 (4.2)</td>
<td>100.0</td>
</tr>
<tr>
<td>4. Stroke</td>
<td>2.0 (10.7)</td>
<td>9.3 (3.6)</td>
<td>28.1</td>
</tr>
<tr>
<td>5. Ischaemic heart disease</td>
<td>2.0 (10.6)</td>
<td>8.6 (3.3)</td>
<td>15.9</td>
</tr>
<tr>
<td>6. Osteoarthritis</td>
<td>0.0 (0.1)</td>
<td>8.1 (3.1)</td>
<td>99.7</td>
</tr>
<tr>
<td>7. Refractive errors</td>
<td>0.0 (0.0)</td>
<td>7.4 (2.9)</td>
<td>100.0</td>
</tr>
<tr>
<td>8. Breast cancer</td>
<td>0.7 (3.6)</td>
<td>7.3 (2.8)</td>
<td>17.3</td>
</tr>
<tr>
<td>9. Migraine</td>
<td>0.0 (0.0)</td>
<td>6.4 (2.5)</td>
<td>100.0</td>
</tr>
<tr>
<td>10. Colorectal cancer</td>
<td>0.7 (3.5)</td>
<td>4.9 (1.9)</td>
<td>18.2</td>
</tr>
<tr>
<td>Total from the top 10 causes</td>
<td>7.3 (37.9)</td>
<td>120.7 (46.9)</td>
<td>76.4</td>
</tr>
<tr>
<td>Total from all causes</td>
<td>19.2 (100)</td>
<td>257.5 (100)</td>
<td>65.5</td>
</tr>
</tbody>
</table>

Note: Disease conditions are presented in decreasing order of DALYs estimates. DALYs: disability-adjusted life years; YLDs: years lived with disability.

value < 0.001) and YLls (correlation coefficient: 0.462; P value < 0.001) showed moderate associations with DALYs, as evidenced by their correlation coefficients around 0.50. YLDs had a high correlation with DALYs (correlation coefficient: 0.797; P value < 0.001).

Discussion

To the best of our knowledge, this study is the first to specifically present an estimation of the overall burden of disease for the Valencian population. Our results clearly indicate the public health relevance of specific disease conditions and injuries in terms of population burden of ill-health and disability. In the region, the leading causes of disease burden when both fatal and non-fatal outcomes of diseases are taken into account were chronic non-communicable diseases. Similarly, the greatest number of DALYs was attributed to neuropsychiatric conditions, malignant tumors and cardiovascular diseases. In terms of specific causes, the burden of disease was highest for unipolar depression, followed by Alzheimer’s and other dementias, ischaemic heart disease, strokes, hearing loss and lung cancer, like in other developed countries. Table 3 shows the annual DALYs calculated for different populations (including the Region of Valencia), and adjusted DALYs rates using 2008 world population as standard. When compared, the proportion accounted by YLDs in the Region of Valencia was lower than those in Europe and worldwide.

The impact of chronic non-communicable diseases is growing steadily over recent years. Recent evidence suggests that premature mortality and disability from cardiovascular diseases, cancers and mental disorders occur at earlier ages where prevention has not been made a priority and effective interventions are not widely available. Furthermore, people behaviors are...
Fig. 3. Relationship between (a) crude mortality, (b) years of life lost (YLLs), (c) years lived with disability (YLDs) and disability-adjusted life years (DALYs). Region of Valencia, 2008. (A) The scatter-plot shows the difference between crude deaths and DALYs. Number of observations = 97 (21 categories and 76 subcategories). The size of the square is directly related to the weighted contribution of each disease condition(s) to the total burden of disease. The solid line represents the linear regression with an adjusted $R^2 = 0.393$. Spearman’s rank-correlation coefficient = 0.428 (p value < 0.001). (B) The scatter-plot shows the difference between YLLs due to premature deaths and DALYs. Number of observations = 97 (21 categories and 76 subcategories). The size of the square is directly related to the weighted contribution of each disease condition(s) to the total burden of disease. The solid line represents the linear regression with an adjusted $R^2 = 0.339$. Spearman’s rank-correlation coefficient = 0.462 (p value < 0.001). (C) The scatter-plot shows the difference between YLDs and DALYs. Number of observations = 97 (21 categories and 76 subcategories). The size of the square is directly related to the weighted contribution of each disease condition(s) to the total burden of disease. The solid line represents the linear regression with an adjusted $R^2 = 0.772$. Spearman’s rank-correlation coefficient = 0.797 (p value < 0.001).

influenced by many factors, including environment and economic pressures, which may result in poor diet choices or limited physical activity. Some estimates of the summary effects of the leading chronic disease risk factors (e.g., tobacco use, raised blood pressure, and poor diet) indicate that more than 30% of the burden of chronic diseases and more than 50% of deaths from chronic disease are attributable to a relatively small number of modifiable risks. The need to prevent and understand the importance of chronic diseases and risk factors calls for an urgent action against them. Along these actions, it is essential to develop evidence-based recommendations and initiatives that contribute to the prevention of chronic non-communicable diseases and thus reduce the burden caused by them. There are strong arguments for focussing efforts of health services on chronic disease management programs. Such an approach has potential to reduce both the financial and health impacts of the disease conditions by identifying people with a potential or active chronic disease, target services to them based on their level of risk, monitor their condition, attempt to modify their behavior, and adjust their therapy to prolong life, minimize complications, and reduce the need for costly acute care interventions.

Recently, the Valencia Regional Health Plan 2010/2013 has promoted health strategies to ensure quality of local health care services and help people achieve and maintain good health. Particularly, the Valencian Regional Government is elaborating different disease control plans focusing on disease prevention and treatment for cancer, cardiovascular disease (including stroke), diabetes, respiratory diseases, among other chronic conditions. It is noteworthy to mention the fact that even though neuropsychiatric conditions are the leading causes of DALYs in the region, historically most of the regional healthcare services have gone to other disease control programs. On this regard, there has been much less attention paid to the reduction of the burden of mental health, with no formal regional prevention strategy in place (excluding drug dependency and other addictive disorders).

On the other hand, the Regional Strategic Plan of Research, Development and Innovation in Public Health has prioritized research activities to estimate the current burden of chronic non-communicable diseases and identify risk factors that contribute to the populations disease burden, and evaluate strategies to help patients and caregivers themselves control and prevent ill-health and reduce the associated adverse effects. On this regard, burden of disease analyses in our study could provide some of the information required for developing future strategies and could help shed some light on debates for setting health care priorities based on the population’s needs. These results can serve as baseline against which the future evolution of population health status of the Valencian population can be compared in a more complete way than using only mortality data or a collection of heterogeneous morbidity data. Furthermore, where scientific evidence exists on the (cost-) effectiveness of particular health services, our results can also provide data inputs necessary for models of further health impact assessments considering the implementation of alternative interventions.

This study represents the first attempt to identify the most important health problems in the Region of Valencia using DALYs as a summary measure of population health. Combining mortality, morbidity and disability data allowed for comparisons between specific diseases and injuries that would not be comparable otherwise. Some of the most important problems identified (e.g., bipolar depression, alcohol use disorders, osteoarthritis, etc.) would have been overlooked in an analysis based solely on mortality data as the greater weight of disease burden of each of these conditions is represented by the disability component.

It is noteworthy that there exist a number of methodological limitations which require further development in order to improve DALY estimates provided here. The most difficult calculation posed by our study was that of YLDs. On this regard, we believe that the main limitation of this analysis is the lack of local incidence and severity (disability weights) estimates which led us to assume the
impact of ill-health for the EURO-A subregion was similar to that in the
Valencian population. As in other national and local burden of
disease studies that have also applied YLD-to-YLL ratios to
calculate DALY estimates,17–43 we believe that such assumptions
introduce a certain level of uncertainty into the results. Thus, our
study points to the need for consistent long-term data collection,
particularly for those conditions where the uncertainty component
plays a minor contributor in the overall burden of disease.
Particularly, key focus areas of current work include the use of
administrative and clinical recording systems to monitor
diseases of high morbidity and to evaluate the effectiveness of
interventions on specific conditions.44–46 On the other hand,
discount rate and age weighting were applied as proposed in the
semina study. The consideration of age weights is based on
a number of studies that assigns social preference towards life
years of young adults (over an older adult or young child).
However, not all such studies agree that the youngest and oldest
ages should be given less weight; nor do they agree on the
relative magnitude of the differences. Furthermore, the standard
DALY form includes a 3% discount rate with time, thus favoring
immediate over future health benefits. This assumption may
increase the fraction of the disease burden due to YLD and
decrease the burden of disease in the youngest people (although
this influence would be more relevant in regions or diseases with
high infant mortality). However, some have argued that these
parameters are an arbitrary choice not empirically based that
adds an extra level of complexity to analyses or that have not
been validated for large populations.47 Key challenges to the
DALY framework have focused on the equity implications of the
assumptions used in social values.48 Despite past criticisms, we
believe there exists no proposed alternatives that have received
greater acceptance. It is noteworthy the fact that in the GBD
study, sensitivity analyses changing these parameters showed
that the qualitative results were remarkably insensitive into the
calculation of DALYs.49

In summary, the burden of disease in the Region of Valencia was
fundamentally attributable to chronic non-communicable dis-
eases, with neuropsychiatric conditions, malignant tumors and
vascular diseases being the most burdensome conditions in
both sexes. Many health authorities have launched burden of
disease studies using DALYs in a similar manner to guide health
policy. Health services researchers have encouraged the use of
summary measures of population health to assess health systems
performance, prioritize biomedical and public health research
agendas, and evaluate the appropriateness of health research
expenditures.40 At this local level, the analyses based on DALYs
may provide a more comprehensive picture of the impact of the
different diseases and injuries on the population health and can be
useful to guide the debates on rational priority-setting in public
health.

Conflict of interest

The authors would like to thank the valuable comments and
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CLINICA. The views expressed are those of the authors and should
not be understood or quoted as being made on behalf or reflecting
the position of any institution. The authors declare that they have
no competing interests.

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