

## **Supplementary Data**

### **The Economic Burden of Cardiovascular Diseases in the Enlarged European Union**

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In the main section of the paper we provided a brief summary of the main methods used in order to estimate health care resource use, unit costs, and other CVD-morbidity and mortality data. To benefit the reader, in this section of the article we provide detailed methodology and sources used in estimating aggregate health care resource use data (e.g. all-cause doctor consultations and A&E visits), health care unit costs, all cause absence of work and the number of EU citizens hampered in daily activities due to CVD.

## **Health service utilisation**

### *Primary care*

For the countries with no CVD-specific GP consultation rates, we began using national data on the annual number of GP consultations for all reasons<sup>1</sup>(1-10). Where national data on total number of visits were not available, international health surveys(11) provided the number of GP visits per capita which was multiplied by the country's total population<sup>2</sup>. For the remainder<sup>3</sup>, the number of outpatient visits per capita(12;13) which comprised both GPs and specialists' visits, was multiplied by the country's population and separated using the GP/Specialist ratios of similar countries. Having obtained a total, this was then multiplied by the proportion of hospital discharges due to CVD-related diseases. In Malta, the total visits were allocated to CVD, CHD and cerebrovascular disease, using a national health survey(6). In Finland, total GP visits were allocated to CVD using the proportion reported in a Finish cost-of-illness study(14).

### *Hospital outpatient care*

In the UK, the number of outpatient visits related to CVD was obtained from several sources(15-19).

For the majority of EU countries, there were no direct estimates of the quantity of outpatient care visits to treat CVD. Therefore, the total number of outpatient visits due to all-cause disease were obtained(1-4;6-10;20-22) for 12 countries<sup>4</sup> and adjusted to CVD

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<sup>1</sup> Cyprus, Estonia, Finland, Hungary, Lithuania, Malta, Poland, Portugal, Slovenia, Spain, and Sweden.

<sup>2</sup> Austria, Denmark, Greece, Ireland, Italy, and Luxembourg.

<sup>3</sup> Slovakia (Poland was the similar country), Latvia (Estonia was the similar country) and Czech Republic (Hungary was the similar country).

<sup>4</sup> Belgium, Cyprus, Denmark, Estonia, Finland, Hungary, Ireland, Malta, Poland, Slovenia, Spain and Sweden.

and its subgroups using the proportion of hospital discharges due to CVD conditions. In Finland, out-patient visits were allocated to CVD using the proportion reported on a Finnish CVD cost-of-illness study(14). For Austria, Greece, Italy and Luxembourg, health surveys(23) provided the number of specialist visits per capita which was multiplied by the country's total population. In the remaining countries<sup>5</sup> no data on specialists' visits was available, so the number of outpatient visits per capita(12;13), which comprised both GPs and specialists' visits, was multiplied by the country's population and separated using the GP/Specialist ratios of similar countries.

#### *Accident and emergency (A&E)*

For ten countries<sup>6</sup>, the only data available concerned the total number of attendances due to all causes(1;6;7;9;13;20;24-27). For several countries (put reference), no data on A&E activity was found. As a result, to obtain the total number of A&E visits in these countries, the 25 countries were separated into three groups according to their gross national incomes. The high income group was composed of Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, Sweden, and the UK; the middle income group was composed of Czech Republic, Cyprus, Greece, Portugal, Slovenia and Spain; the low income group was composed of Estonia, Hungary, Latvia, Lithuania, Poland, and Slovakia. For those countries reporting the total number of A&E visits, per capita A&E visits were determined and averaged across the countries belonging to the same income group. This ratio was then applied to the countries in the same income group for which no data were available.

#### *Hospital inpatient care*

In Finland, inpatient hospital days due to CHD and cerebrovascular disease were obtained directly from a national source(28), while inpatient hospital days due to CVD were estimated using the product of number of hospital discharges and average length of

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<sup>5</sup> Slovakia (Poland was the similar country), Latvia (Estonia was the similar country) and Czech Republic (Hungary was the similar country).

<sup>6</sup> Belgium, Cyprus, Estonia, Ireland, Italy, Latvia, Malta, Poland, Portugal, and Spain.

stay, both derived from the OECD(12). For the majority of countries<sup>7</sup>, disease-specific average length of stay and hospital discharges were found in international data(12;29). For the remaining countries, CVD-related length of stay was not available, and a regression was performed to estimate the missing data. Hence, CVD-related length of stay was regressed on average length of stay from all causes, and CHD and cerebrovascular length of stay were regressed on average length of stay due to CVD.

Due to data availability, day case hospital admissions were estimated separately for four countries<sup>8</sup>. In the UK and Italy, resource use was obtained from hospital episode statistics and Ministry of Health reports, respectively(30;31). For Ireland and Sweden national sources provided the resource use for all causes(10;22), which were adjusted to CVD using the proportion of hospital discharges due to CVD related illnesses.

The number of annual cardiac rehabilitation sessions in Italy was obtained from national sources(31). In the UK, the number of hospital patients with CVD who underwent full cardiac programmes(32;33) was estimated taking into account the programme drop out rate(34). For Sweden(10), the available data concerned rehabilitation sessions for various causes, which were adjusted to CVD-related sessions using the proportion of hospital discharges due to the disease.

### **Health care unit costs**

The unit costs of primary care and outpatient care activities were directly obtained from national sources in eight countries<sup>9</sup>(2;10;35-41). In Hungary, the proportion of health care expenditure due to primary care and outpatient care activities was taken from a report by the European Observatory on Health Care Systems(42), which was then divided by the total number of activities to obtain their unit cost. Four published economic evaluations(43-46) provided estimates for the unit costs of seven of the remaining countries<sup>10</sup>. For the remaining six countries<sup>11</sup>, the coefficients from the regressions of

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<sup>7</sup> Hospital discharges were found for all countries. CVD, CHD and cerebrovascular length of stay figures were missing for Cyprus, Malta and Slovenia. CHD and cerebrovascular length of stay was missing for Estonia, Latvia and Lithuania.

<sup>8</sup> Ireland, Italy, Sweden and the UK.

<sup>9</sup> Belgium, Cyprus, Estonia, Italy (outpatient care only), Luxembourg, Portugal, Spain, Sweden, and the UK.

<sup>10</sup> Czech Republic, Denmark, Finland, Greece, Italy (primary care only), Ireland, and Poland.

<sup>11</sup> Austria, Latvia, Lithuania, Malta, Slovakia and Slovenia.

primary care unit cost on health care expenditure, and outpatient visit cost on primary care unit cost, enabled the estimation of each country's unit cost.

Only national sources in Portugal(39), Spain(40) and the UK(47), were found to provide the unit cost of an A&E visit. For five of the remaining countries<sup>12</sup>, the unit cost was taken from an economic evaluation of a drug in 12 different European countries(46). For the rest of the countries, no national sources or published studies were identified, and A&E unit cost was regressed on the cost of an inpatient hospital bed day.

The unit cost of an inpatient day in hospital was obtained from national sources(2;15;39;40;48;49) in six countries<sup>13</sup>. A study looking at health care utilisation in Ireland provided the unit cost of a day spent in hospital(45). In the thirteen countries<sup>14</sup> where the unit cost of hospital inpatient stay was not directly available, the total expenditure in inpatient care(12;29;50-53) was divided by the total number of hospital inpatient days for all reasons. In Malta and Cyprus, the total inpatient expenditure was not available, and the hospital day unit cost was regressed on health expenditure per capita.

### **Estimation of non-health service costs**

In order to estimate the costs of informal care, we first calculated the number of CVD-sufferers severely hampered due to CVD-related diseases. The first step was to estimate the number of people severely hampered in daily activities due to illness, physical or mental problems for each country. For 15 countries<sup>15</sup>, the proportion of population in this condition, by age group (15-64 and 65 or over), was obtained from the European Community Household Panel survey(54). The average proportion from these countries was used for the remaining ten countries. These proportions were then multiplied by the population in each age group to obtain the number of people with limiting conditions. The number of people with limiting conditions due to CVD-related diseases was then estimated using the proportion of hospital discharges in each age group due

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<sup>12</sup> Belgium, Czech Republic, Italy, Poland, and Sweden.

<sup>13</sup> Estonia, Italy, Portugal, Spain, Sweden and the UK.

<sup>14</sup> Austria, Belgium, Czech Republic, Denmark, Finland, Greece, Hungary, Latvia, Lithuania, Luxembourg, Poland, Slovakia, and Slovenia.

<sup>15</sup> Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the UK.

cardiovascular disease categories. It was assumed that the higher the hospitalisation rate due to a CVD condition, the higher the probability that people would be hampered in their daily activities due to this condition.

Annual earnings were obtained from reports by the European Commission(55) and national sources(8;56-63), and then adjusted to hourly wage rates. Unemployment and activity rates were obtained from national institutes of statistics(8;57;59;61;64-68) and from the International Labour Organisation(69).

### **Estimation of productivity costs**

Only for Cyprus was data on CVD-related deaths not recorded, hence data from Greece, which was found to be similar in terms of life-expectancy, geographical location, and gross national income per capita were used to estimate the number of related deaths. This was undertaken by standardising age and gender specific mortality rates and applying them to the Cypriot population.

Absence from work due to all-cause disease was derived from a variety of sources. Total number of absent days due to illness was obtained from the respective national statistics institutes for Slovenia(8) and the Czech Republic(70). For the remaining 21 countries, the total number of absent days to illness was derived from average per employee estimates. In Ireland these were derived from a 2003 report from the Irish Business and Employee Confederation(71). For five countries<sup>16</sup>, this information was obtained from WHO data(29), which reported the average number of working days lost per employee per year due to sickness or injury. For twelve other countries<sup>17</sup> OECD data(12) provided the average number of working days lost per year due to illness per employed person. Data for Cyprus, Greece and Malta was not available and as a result, absence from work per employee had to be estimated from data from other countries. Absence from work for Greece was derived by taking an average of the absence reported in Italy, Ireland and Portugal, as a study examining the distribution of sickness absence in the European Union countries(72) found that sickness absence was not significantly different in these four countries. Due to the similarities between Greece

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<sup>16</sup> Belgium, Estonia, Latvia, Lithuania and the Netherlands.

<sup>17</sup> Denmark, Finland, France, Germany, Hungary, Italy, Luxembourg, Poland, Portugal, Slovakia, Spain and Sweden.

and Cyprus, this estimate of absence from work due to illness was used for Cyprus. For Malta, averages from four countries<sup>18</sup>, which were found to be comparable in terms of economic activity rates and national income per capita, were used to derive absence from work due to illness per employee. For these 21 countries, the number of sickness days per employee was multiplied by the number of employed persons in each country, which were derived from the International Labour Organisation labour force surveys(69), to obtain the total number of working days lost due to illness in each country.

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<sup>18</sup> Czech Republic, Portugal, Slovenia and Spain.

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