ONLINE APPENDIX

In this online appendix, we provide details on methodology and data sources used for the estimation of the costs of stroke in 32 European countries as well as more detailed results.

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METHODS

Primary, outpatient and emergency care

Primary care activities consisted of stroke-related visits to or from general practitioners (GPs). Outpatient care comprised specialist consultations taking place in outpatient wards, clinics, or patients' homes due to stroke. Accident and emergency (A&E) consisted of all stroke-related hospital emergency visits.

Table A1. Sources of healthcare resource use by category and country

	Primary care	Outpatient care	A&E	Inpatient care
Austria	1	1	2	1
Belgium	3	4	4	1
Bulgaria	1	1	5	1
Croatia	6	6	6	1
Cyprus	7	7	7	1
Czech Rep.	8	9	10	1
Denmark	11	12	13	1
Estonia	14	14	14	1
Finland	15	15	15	1
France	16	16	17	1
Germany	1	1	18	1
Greece	19	19	18	1
Hungary	20	21	22	1
Iceland	23	24	13	1
Ireland	1	1	25	1
Israel	26	26	18	27
Italy	1	1	28	1
Latvia	29	29	30	1
Lithuania	31	31	32	1
Luxembourg	33	33	4	1
Malta	34	34	34	1
Netherlands	35	35	36	1
Norway	37	38	39	1
Poland	40	40	40	1
Portugal	1	41	41	1
Romania	42	42	43	1
Slovakia	44	44	44	1
Slovenia	45	45	6	1
Spain	46	47	47	1
Sweden	48	48	49	1
Switzerland	50	50	51 52	1
UK	53 54	55-58	55 59-61	1

Country-specific overall visits to primary and outpatient care due to all conditions were obtained for all countries (**Table A1**). In four countries (Iceland, Israel, Luxembourg, Slovenia) we found no data on A&E activity. As a result, we used the total per capita A&E visits from similar countries. Therefore, for:

1) Iceland we used estimates from Denmark;[13]

2) Israel we used estimates from Greece;[18]

3) Luxembourg we used estimates from Belgium;[4] and

4) Slovenia we used estimates from Croatia.[6]

To the total number of primary, outpatient and A&E visits, we determined the number of visits for those under and above the age of 50. Wherever~~,~~ possible, this was obtained from the same sources used to identify all-cause resource use. If this was not available, we obtained the proportion of primary and outpatient care visits in those aged 50 years and above using data from EUROSTAT,[1] which contained self-reported number of primary and outpatient care visits by age. For A&E, when visits were not reported by age group, we used the proportion of all hospital discharges for those aged over 50 years.[1] To obtain the proportion of primary, outpatient and A&E visits due to stroke in those under the age of 50, we estimated the under 50 proportion of overall hospital discharges due to stroke[1], and applied it to the total number of visits for survivors under the age of 50.

For patients over the age of 50, we used data from the Survey of Health, Ageing and Retirement in Europe (SHARE).[62] SHARE is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks, freely available to researchers, in which all data are collected via face-to-face, computer-aided personal interviews, supplemented by self-completion paper and pencil questionnaires (**Table A2**). The SHARE target population consists of all persons aged 50 years and over who have their regular domicile in the respective SHARE country. Persons are excluded if they are incarcerated, hospitalized or out of the country during the entire survey period, unable to speak the country's language or have moved to an unknown address.

Table A2. WAVES and Field time available in SHARE survey

Wave	Field time
1	2004-2006
2	2006-2007
3 (SHARELIFE)	2008-2010
4	2010-2012
5	2013
6	2015
7	2017

We used data collected in Wave 2, Wave 4 and Wave 6 which included over 30,000 respondents resident in 21 European countries (Austria, Belgium, Croatia, the Czech Republic, Denmark, Estonia,

France, Germany, Greece, Hungary, Ireland, Italy, Israel, Luxembourg, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden and Switzerland). Residents from Ireland and Hungary were only included in Waves 2 and 4 respectively, and the data collected in these two waves were combined with Wave 6 data on the remaining 19 countries. For countries not in SHARE, we combined data from similar countries that were in SHARE to obtain estimates for the 11 remaining countries. Therefore, for Bulgaria, Latvia, Lithuania, Romania, and Slovakia we used combined data from the Czech Republic, Estonia, Hungary, Poland and Slovenia. For Iceland, Finland and Norway we used combined data from Denmark and Sweden. For Cyprus and Malta we used combined data from Greece, Italy, Israel, Portugal and Spain. Finally, for the UK we used combined data from Austria, Belgium, France, Germany, Ireland, Luxembourg, and the Netherlands.

Table A3. Proportion of primary, outpatient and A&E care visits due to stroke

	Primary care		Outpatient care		A&E care	
	<50 years	≥50 years	<50 years	≥50 years	<50 years	≥50 years
Austria	2.28%	7.38%	2.28%	7.39%	2.28%	6.63%
Belgium	1.22%	4.36%	1.22%	4.37%	1.22%	3.94%
Bulgaria	2.92%	6.79%	2.92%	6.73%	2.92%	6.76%
Croatia	2.26%	4.91%	2.26%	4.97%	2.26%	4.19%
Cyprus	1.96%	4.95%	1.96%	4.89%	1.96%	4.98%
Czech Rep.	3.66%	5.03%	3.66%	5.05%	3.66%	4.86%
Denmark	1.89%	4.59%	1.89%	4.52%	1.89%	5.37%
Estonia	5.16%	6.20%	5.16%	6.15%	5.16%	7.27%
Finland	3.06%	6.24%	3.06%	6.13%	3.06%	6.69%
France	0.91%	4.55%	0.91%	4.52%	0.91%	7.69%
Germany	2.97%	4.51%	2.97%	4.52%	2.97%	4.15%
Greece	1.96%	4.71%	1.96%	4.58%	1.96%	6.96%
Hungary	5.66%	7.73%	5.66%	10.32%	5.66%	6.47%
Iceland	2.35%	6.24%	2.35%	6.13%	2.35%	6.69%
Ireland	0.65%	4.97%	0.65%	5.01%	0.65%	6.67%
Israel	1.96%	6.48%	1.96%	6.48%	1.96%	6.47%
Italy	3.89%	3.83%	3.89%	3.83%	3.89%	3.42%
Latvia	5.16%	6.79%	5.16%	6.73%	5.16%	6.76%
Lithuania	5.31%	6.79%	5.31%	6.73%	5.31%	6.76%
Luxembourg	1.79%	2.79%	1.79%	2.80%	3.66%	4.86%
Malta	1.18%	4.95%	1.18%	4.89%	1.18%	4.98%
Netherlands	1.83%	3.91%	1.83%	3.87%	1.83%	4.27%
Norway	2.32%	6.24%	2.32%	6.13%	2.32%	6.69%
Poland	2.58%	5.35%	2.58%	5.36%	2.58%	5.90%
Portugal	1.84%	6.79%	1.84%	6.69%	1.84%	7.17%
Romania	2.92%	6.79%	2.92%	6.73%	2.92%	6.76%
Slovakia	4.16%	6.79%	4.16%	6.73%	4.16%	6.76%
Slovenia	2.20%	5.75%	2.20%	5.69%	2.20%	6.89%
Spain	1.80%	3.21%	1.80%	3.16%	1.80%	3.80%
Sweden	3.32%	6.21%	3.32%	6.14%	3.32%	6.42%
Switzerland	2.61%	2.67%	2.61%	2.64%	2.61%	3.07%
UK	1.13%	5.16%	1.13%	5.11%	1.13%	5.05%

Participants in SHARE were asked, amongst other things, the number of times they had visited a primary health care physician, specialist in an outpatient setting and attended A&E over the last 12 months. Using three Poisson regressions, one for each type of resource use, we estimated the country-specific number of visits given the patient had a history stroke, after adjusting for presence of dementia and/or other health conditions and country of residence. This expected number of visits was then multiplied with the number of people with stroke in each country in SHARE, and divided by the total number of visits in that country (i.e. number of people responding in SHARE multiplied by the mean number of visit), in order to obtain the proportion of primary, outpatient, and A&E visits due to stroke in each country (**Table A3**).

Hospital inpatient care

Inpatient care was estimated from the number of stroke-related days in hospital, including day case admissions. The number of days in hospital, which included day cases, was obtained for all countries by primary diagnosis of stroke. Except for Israel, where data was derived from the OECD,[27] all stroke-related days in hospital and day cases were obtained from EUROSTAT.[1]

Healthcare unit costs

For all countries, health care resource use was valued using country-specific unit costs, which were derived from published studies, reports, and national fee schedules. Sources of unit costs per country and resource use category are reported in **Table A4**. For some countries unit costs were derived from the predictions of linear regression analyses of the unit costs of countries with available data.[63 64]

Expenditure on Medications

The costs related to consumption of stroke-related medication were included in the analysis.

OECD Health data provided the total CVD-related pharmaceutical expenditure, defined as those medications coded under the Anatomical Therapeutic Chemical (ATC) Classification Code C (Cardiovascular System), for Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.[27] CVD-related expenditure

on medication was obtained from other sources for: Bulgaria,[1 65] Croatia,[66] Cyprus,[1 67] Latvia,[68] and Poland.[1 69] For Israel, Malta and Romania no data on CVD-related pharmaceutical expenditure was identified. Therefore, for: 1) Israel we used estimates from Italy, 2) Malta we used the average from Cyprus, Italy, Portugal, and Spain; and 3) Romania we used estimates from Bulgaria.

Table A4. Sources of unit costs by country and healthcare utilisation category

	Primary care	Outpatient care	A&E	Inpatient care
Austria	2	2	70	1
Belgium	71	71	71	72
Bulgaria	1	1	Regression*	1
Croatia	73	73	73	73
Cyprus	74	74	75	76
Czech Rep.	9	9	Regression*	9
Denmark	77	77	78	1
Estonia	14	14	14	14
Finland	79	79	79	80
France	16	16	81	1
Germany	82	83	82	84
Greece	85	86	85	85
Hungary	21	21	22	22
Iceland	87	87	88	87
Ireland	89	89	89	90
Israel	91	91	91	91
Italy	82	82	82	1
Latvia	29	29	Regression	1
Lithuania	92	92	82	1
Luxembourg	93	93	93	1
Malta	34	Regression	94	94
Netherlands	94	94	95	94
Norway	96	96	96	97
Poland	98	99	99	1
Portugal	100	101	101	101
Romania	102	102	Regression	1
Slovakia	102	102	Regression	1
Slovenia	102	102	94	1
Spain	103	103	103	104
Sweden	105	49	49	49
Switzerland	98	98	106	98
UK	107	108	108	108

As only France, Germany and the Netherlands provided data on the proportion of CVD-related pharmaceutical expenditure on stroke,[84 109 110] the proportion of pharmaceutical expenditure due to stroke was averaged across the three countries and applied to the total CVD sales in the remaining countries.

Social care costs

Nursing and residential care was measured as the number of stroke-related days spent in care homes. There are two types of care homes, nursing and residential homes. A residential home provides care for people who are not able to manage everyday tasks or maintain an independent home of their own while a nursing home provides 24-hour nursing care. Given the data available, we conservatively assumed that only those aged 65 years of age or more would be institutionalised in a nursing/residential care home.

Data on the number of people aged 65 years or over living in a nursing or residential home care was obtained from the OECD for: Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Luxembourg, the Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and Switzerland.[27] For seven other countries this information was derived from country-specific reports drawn up by the European Commission: Bulgaria,[111] Cyprus,[112] Italy,[113] Latvia,[114] Lithuania,[115] Malta,[116] and Poland.[117] For the remaining 4 countries, this information was derived from a number of different sources: Austria,[118] Croatia,[6] Greece,[119] and the United Kingdom.[120]

Participants in SHARE were asked whether they lived in a nursing or residential home. Using a logistic regression analysis, we estimated the country-specific probability of a respondent being institutionalised in a nursing/residential care home due to stroke, adjusting for age, presence of stroke, dementia and/or other health conditions and country of residence. This proportion was then applied to the total number of institutionalised people, and multiplied by 365.25 to obtain the annual number of days institutionalised in a nursing/residential home due to stroke.

In addition, participants in SHARE were asked whether a relative or friend they cared for had died within the last 12 months. If that was the case, participants were further asked, the age and gender of the deceased, the place of death (which could include nursing or residential care home) and the main cause of death (which could include stroke). We, therefore, evaluated the number of people who died within the last 12 months in a nursing/residential care home due to stroke. This was undertaken by adding the age and sex-specific products of:

1) Number of stroke related deaths.[1 27]; and

2) Probability of having been institutionalised before a stroke-related death.

This was estimated using a logistic regression, adjusting for stroke death, country of residence, age and gender.

As it was likely that these people would not have been institutionalised for the full year, we assumed that all patients died halfway through the year. Therefore, the total number of people who died as a result of stroke in a nursing/residential care home was multiplied by 183 days. This estimate was then added to the number of institutionalised days for people living with stroke to obtain the annual number of days institutionalised in a nursing/residential home due to stroke.

Table A5. Unit costs (€)

	Visits			Day in	Day in	Hourly earnings		Yearly earnings		Daily
	GP	Outpatient	A&E	hospital	nursing home	Employed	Non-employed	Male	Female	earnings
Austria	55	69	160	588	136	24	10	50,443	38,703	195
Belgium	28	58	91	966	74	26	9	49,717	45,237	207
Bulgaria	6	24	31	93	13	4	1	8,117	6,758	33
Croatia	17	15	261	110	16	8	3	14,992	13,737	63
Cyprus	15	30	51	148	70	14	7	28,508	23,155	113
Czech Republic	12	16	83	261	34	8	3	16,380	12,271	63
Denmark	21	86	139	1,540	245	35	22	71,550	56,239	280
Estonia	16	53	57	269	29	8	3	18,219	12,586	67
Finland	153	377	423	778	196	24	14	50,407	39,176	196
France	39	146	91	717	82	21	10	41,687	34,469	166
Germany	53	78	96	868	131	29	9	52,774	52,774	229
Greece	20	50	72	476	53	12	4	24,769	20,527	100
Hungary	5	7	121	168	19	7	2	13,260	10,922	53
Iceland	84	141	300	1,311	227	27	19	52,962	44,998	214
Ireland	51	137	272	671	147	27	9	54,479	45,724	219
Israel	12	69	200	501	112	16	7	34,456	22,548	125
Italy	23	88	235	654	132	20	10	38,697	32,266	156
Latvia	11	40	39	93	14	7	2	14,199	11,069	55
Lithuania	11	27	22	123	9	6	2	12,056	9,638	47
Luxembourg	46	65	81	1,175	205	33	12	62,491	58,530	264
Malta	39	58	97	413	176	13	4	26,211	21,937	107
Netherlands	32	134	167	1,446	196	27	9	53,790	44,018	214
Norway	70	156	152	1,364	387	30	23	59,440	51,206	241
Poland	6	54	24	197	99	7	3	14,430	12,032	58
Portugal	31	68	96	312	31	10	4	20,418	17,025	82
Romania	9	14	70	96	14	5	2	9,745	9,165	41
Slovakia	22	33	41	198	31	8	3	15,693	12,159	61
Slovenia	26	37	98	333	61	13	5	25,596	23,413	107
Spain	39	130	185	714	92	16	5	31,161	27,022	127
Sweden	162	428	394	922	211	27	13	52,580	45,557	214
Switzerland	49	49	142	1,219	229	38	18	73,725	64,884	303
United Kingdom	34	137	169	665	136	23	9	48,109	35,491	183

A day in a nursing home was then valued using a number of different country-specific sources. For 10 countries, this information was obtained from long-term care institutionalisation expenditure estimates

compiled in country-specific reports authored by the European Commission: Bulgaria,[111] Cyprus,[112] Greece,[121] Hungary,[122] Italy,[113] Latvia,[114] Lithuania,[115] Malta,[116] Poland[117] and Slovenia.[123] For the remaining countries, unit costs were obtained from a wide range of sources: Austria,[124] Belgium,[125] Croatia,[126] Czech Republic,[127] Denmark,[128] Estonia,[129] Finland,[130] France,[131] Germany,[131] Iceland,[132] Ireland,[133] Israel,[134] Luxembourg,[33] the Netherlands,[135] Norway,[136] Portugal,[137] Romania,[138] Slovakia,[138] Spain,[139] Sweden,[140] Switzerland,[141] and the United Kingdom (**Table A5**).[107]

Informal care

We conservatively assumed that only patients severely limited in daily activities or who were terminally ill would receive informal care. We used country-specific data to estimate the number of people with stroke using prevalence estimates from the Global Burden of Disease (GBD)[142] and then used data from SHARE to assess the informal care needs of stroke patients.[62]

Informal care to patients severely limited in daily activities due to stroke

Hours of informal care for severely limited stroke patients were estimated by adding the country-, age- and sex-specific products of:

1) Prevalence of stroke in the population, which was obtained from prevalence estimates for stroke from the GBD study;[142]
2) Probability of being severely limited in daily activities due to stroke. Using data from SHARE, we undertook logistic regressions adjusting for age, gender, presence of stroke, dementia and other health conditions, and country of residence. As a result, we obtained country-specific estimates of the probability of being severely limited in daily activities due to stroke.
3) Probability of receiving informal care due to stroke. Using data from SHARE, we evaluated the probability that stroke patients received informal care. We performed two logistic regressions (one for care from inside the household and the other for care outside the household) after adjusting for age, gender, presence of stroke, dementia and other health conditions, limitations in daily living and country of residence.
4) Hours of informal care received due to stroke. Using data from SHARE, we performed an ordered logistic regression to assess the amount of informal care time (almost daily, almost weekly, almost every month or less often) that patients with stroke received after adjusting for age,

gender, presence of stroke, dementia and other health conditions, limitations in daily living, and country of residence. These were converted into hours using the information from SHARE on the number of unpaid care hours (either daily, weekly, monthly or annually) patients with stroke received.

Informal care to terminally ill patients with stroke

Hours of informal care for terminally ill stroke patients were estimated by adding the age and sex-specific products of:

1) Number of stroke deaths. Age- and gender-stratified cancer deaths were derived from EUROSTAT (WHO in the case of Israel).[1 143]
2) Probability of receiving informal care in the year before dying from stroke. Using the end-of-life questionnaire, participants in SHARE were asked to report whether they had provided unpaid care for anyone who had died in the last year, including the age of the person to whom care was provided and the health conditions from which that person was suffering. The probability of providing informal care for a stroke patient was estimated using a logistic regression analysis after adjusting for age, gender and country.
3) Hours of informal care received due to stroke. Using data from the end-of-life questionnaire in SHARE, we performed an ordered logistic regression to assess the amount of informal care time (almost daily, almost weekly, almost every month or less often) that caregivers provided to a stroke patient after adjusting for age, gender, and country of residence. These were converted into hours using the information from SHARE on the number of unpaid care hours (either daily, weekly, monthly or annually) that caregivers provided to stroke patients.

Valuing informal care

Participants in SHARE were asked about the relationship between carer and person being cared (e.g. spouse, sibling, offspring, parent friend etc...). We assumed that spouses, siblings and friends providing the care would be of similar age to the patient, therefore carers of patients aged 65 years or more were assumed to be retired, and those carers of patients aged less than 65 years were assumed to be of working-age. If care was being provided by either the patients' children or their children's spouses, then it was assumed that these informal carers would be under 65 years of age.

Using gender-specific economic activity and unemployment rates for each country,[1 144] we then determined the proportion of these carers who were employed or unemployed/economically inactive.

The mean net hourly wage rate was applied to informal care provided by those carers in working age and who were economically active and in employment. Annual earnings were adjusted to hourly wage rates, assuming there were 230 working days each year, and each day consisted of 8 hours of work. For those carers in retirement, unemployed, or economically inactive, the national hourly minimum wage was applied.[1 145] For those countries with no official minimum wage rate (Cyprus, Denmark, Finland, Germany, Italy and Sweden), the worst paid sector in the economy was proxied as a minimum wage.

Morbidity losses

The costs associated with lost productivity due to morbidity were the costs associated with absence of work due to stroke. Morbidity losses could occur due to: individuals taking absence from leave for a defined period of time; or individuals being declared incapacitated or disabled due to their condition, and therefore leaving the labour market. **Table A6** details all the sources used to obtain temporary and permanent absence from work due to stroke.

Temporary absence from work due to sickness

Country-specific overall annual days of sickness leave due to all conditions was obtained for all countries, except for Cyprus (**Table A6**). As a result, we used the total per employed person days of work due to temporary sickness in Greece and multiplied this by the number of employed people in Cyprus.[1 146]

To the total number of days of work due to sickness we applied the proportion of absence that was attributable to stroke using the following:

1. In the Czech Republic,[147] France,[148] Germany,[149] and the UK[150] published data were available on the proportion of temporary absence from work due to stroke;
2. In Austria,[2] Belgium,[151], Estonia,[14] Italy,[152] Luxembourg,[153] the Netherlands,[154] Norway,[155] Poland,[156] Slovenia,[45] and Spain[157] published data were available on the proportion of

temporary absence from work due to CVD. To evaluate the proportion of temporary absence from work due to stroke, we obtained the proportion of CVD-related hospital inpatient days in the working age population due to stroke,[1] and applied it to the total number of CVD-related days of temporary work absence;

3. In Finland[158] and Sweden[159] we obtained data on the proportion of overall permanent absence from work (in the form of disability pensions for the working age population) due to CVD in the working age population, and assumed this would be the same as the proportion for temporary absence from work. To evaluate the proportion of temporary absence from work due to stroke, we obtained the proportion of CVD-related hospital inpatient days in the working age population due to stroke,[1] and applied it to the total number of CVD-related days of temporary work absence;
4. We obtained no information on the proportion of absence from work due to stroke or CVD for 16 countries. Therefore, we used the proportion of temporary absence from work due to stroke for:
    - Slovakia, where estimates from the Czech Republic were used,[147] and
    - Switzerland, where estimates from Germany were used.[149]

    For 14 countries, we used the proportion of temporary absence from work due to CVD for:
    - Bulgaria, Hungary, and Romania, where estimates from Poland were used,[156]
    - Croatia, where estimates from Slovenia were used,[45]
    - Cyprus, Greece and Portugal, where estimates from Spain were used,[157]
    - Denmark and Iceland, where estimates from Sweden were used,[159]
    - Ireland, where estimates from the UK were used,[150]
    - Israel and Malta, where estimates from Italy were used,[152] and
    - Latvia and Lithuania, where estimates from Estonia were used.[14]

    To evaluate the proportion of temporary absence from work due to stroke, we obtained the proportion of CVD-related hospital inpatient days in the working age population due to stroke,[1] and applied it to the total number of CVD-related days of temporary work absence.

Table A6. Sources used to obtain morbidity losses

	Temporary absence from work	Permanent absence from work
Austria	2 120	120
Belgium	160 161	161
Bulgaria	156 162	156 163
Croatia	6 45	6 45
Cyprus	146 157	146 164
Czech Rep.	147	8 147
Denmark	159 165	159 166
Estonia	14	14 167
Finland	158 168	158
France	27 148	169
Germany	149 170	171 172
Greece	146 157	146 164
Hungary	156 173	156 174
Iceland	87 159	159 175
Ireland	150 176	177 178
Israel	27 152	179 180
Italy	152 181	180 182
Latvia	14 183	14 184
Lithuania	14 31	14 185
Luxembourg	153 186	33 153
Malta	34 152	34 180
Netherlands	154 187	154 188
Norway	27 155	155 189
Poland	156	40 156
Portugal	157 190	164 191
Romania	156 163	156 163
Slovakia	147 192	147 192
Slovenia	45	45 193
Spain	27 157	164 194
Sweden	159 195	159 195
Switzerland	149 196	172 197
UK	150	178

Permanent absence from work due to sickness

Country-specific information on the numbers of working-age individuals receiving incapacity or disability benefits and not being able to work due to all conditions was obtained for all countries except for Bulgaria and Cyprus (**Table A6**). As a result, we used the per capita number of people receiving disability benefits in the working age population in Romania[163] and Greece[146] and multiplied this by the working age population in Bulgaria and Cyprus,[1] respectively.

To the total number of people receiving disability benefits we applied the proportion of permanent absence that was attributable to stroke using the following:

1. In Austria,[120] France,[169] Germany[172] and the UK[178] published data were available on the proportion of permanent absence from work due to stroke;

2. In Belgium,[161] Finland,[158] Italy,[180] Luxembourg,[153] Norway,[155] Spain[164] and Sweden[159] published data were available on the proportion of permanent absence from work due to CVD. To evaluate the proportion of permanent absence from work due to stroke, we obtained the proportion of CVD-related hospital inpatient days in the working age population due to stroke,[1] and applied it to the total number of CVD-related number of people receiving disability/incapacity benefits;
3. In the Czech Republic[147] we obtained data on the proportion of temporary absence from work (in the form of sickness days) due to stroke, and assumed this would be the same as the proportion for permanent absence from work; and
4. In Estonia,[14] the Netherlands,[154] Poland,[156] and Slovenia[45] we obtained data on the proportion of overall temporary absence from work (in the form of sickness days) due to CVD, and assumed this would be the same as the proportion for permanent absence from work. To evaluate the proportion of permanent absence from work due to stroke, we obtained the proportion of CVD-related hospital inpatient days in the working age population due to stroke,[1] and applied it to the total number of CVD-related number of people receiving disability/incapacity benefits.

   We obtained no information on the proportion of absence from work due to stroke or CVD for 16 countries. Therefore, we used the proportion of permanent absence from work due to stroke for:

   - Ireland,[178] where estimates from the UK were used, and
   - Switzerland,[172] where estimates from Germany were used.

   For Slovakia we used the proportion of temporary absence from work due to stroke from the Czech Republic.[147]

   For 7 countries, we used the proportion of permanent absence from work due to CVD:

   - Cyprus, Greece and Portugal, where estimates from Spain were used,[164]
   - Denmark and Iceland, where estimates from Sweden were used,[159] and
   - Israel and Malta were estimates from Italy were used.[180]

   For the remaining 6 countries, we used the proportion of temporary absence from work due to CVD:

   - Bulgaria, Hungary and Romania, where estimates from Poland were used,[156]

- Croatia, where estimates from Slovenia were used,[45] and
- Latvia and Lithuania, were estimates from Estonia[14] were used.

To evaluate the proportion of permanent absence from work due to stroke, we obtained the proportion of CVD-related hospital inpatient days in the working age population due to stroke,[1] and applied it to the total number of CVD-related number of people receiving disability/incapacity benefits.

Valuing absence from work

The mean annual earnings were converted to mean daily earnings.[1 145] The product of working days lost and mean daily earnings provided the productivity losses associated with stroke. Furthermore, we used the "friction period" approach, whereby only the first 90 days of work absence were counted, as absent workers are likely to be replaced.[198]

Mortality losses

For all countries, we assumed an initial working age of 15. Age and gender specific deaths due to stroke were obtained for all countries.[1 143] The number of potential working years lost was then estimated as the difference between the age at death and maximum age of retirement (which we set at 79 years of age). However, this estimate would overestimate the total working years lost as not everyone will be economically active (i.e. either working or actively searching for work) or employed. Therefore, age- and gender-specific unemployment and activity rates,[1 144] for each of the 32 countries were applied to the potential foregone earnings due to premature mortality. The total number of working years lost was then multiplied by gender-specific average annual earnings.[1 145] Future earnings lost due to mortality were discounted to present values using a 3.5% annual rate,[199] i.e. the value society attaches to present as opposed to future costs.

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RESULTS

Table A7. Incidence and prevalence of stroke

	Incidence	Prevalence
Austria	23,698	154,877
Belgium	28,085	192,320
Bulgaria	38,368	205,683
Croatia	20,469	98,358
Cyprus	1,573	11,079
Czech Rep.	38,959	216,547
Denmark	12,540	92,553
Estonia	4,610	32,633
Finland	17,429	133,952
France	131,416	942,293
Germany	242,497	1,685,144
Greece	34,149	212,536
Hungary	40,003	237,789
Ireland	7,462	56,931
Italy	166,015	778,199
Latvia	12,188	68,840
Lithuania	15,035	83,143
Luxembourg	1,074	8,273
Malta	892	6,646
Netherlands	35,385	254,094
Poland	124,540	690,591
Portugal	27,447	191,120
Romania	103,102	489,826
Slovakia	20,560	103,365
Slovenia	6,204	38,875
Spain	101,845	550,941
Sweden	24,807	166,065
Total EU-27	1,280,353	7,702,671
UK	134,979	992,413
Total EU-28	1,415,332	8,695,085
Iceland	603	4,167
Israel	11,390	82,396
Norway	12,254	81,671
Switzerland	19,766	135,329
Total Europe	1,459,345	8,998,648

Source: Global Burden of Disease. Global Burden of Disease Tool. http://ghdx.healthdata.org/gbd-results-tool. Accessed 19 September 2019

Figure A1. Tornado plot of the results of the sensitivity analysis on the total costs of stroke, € millions

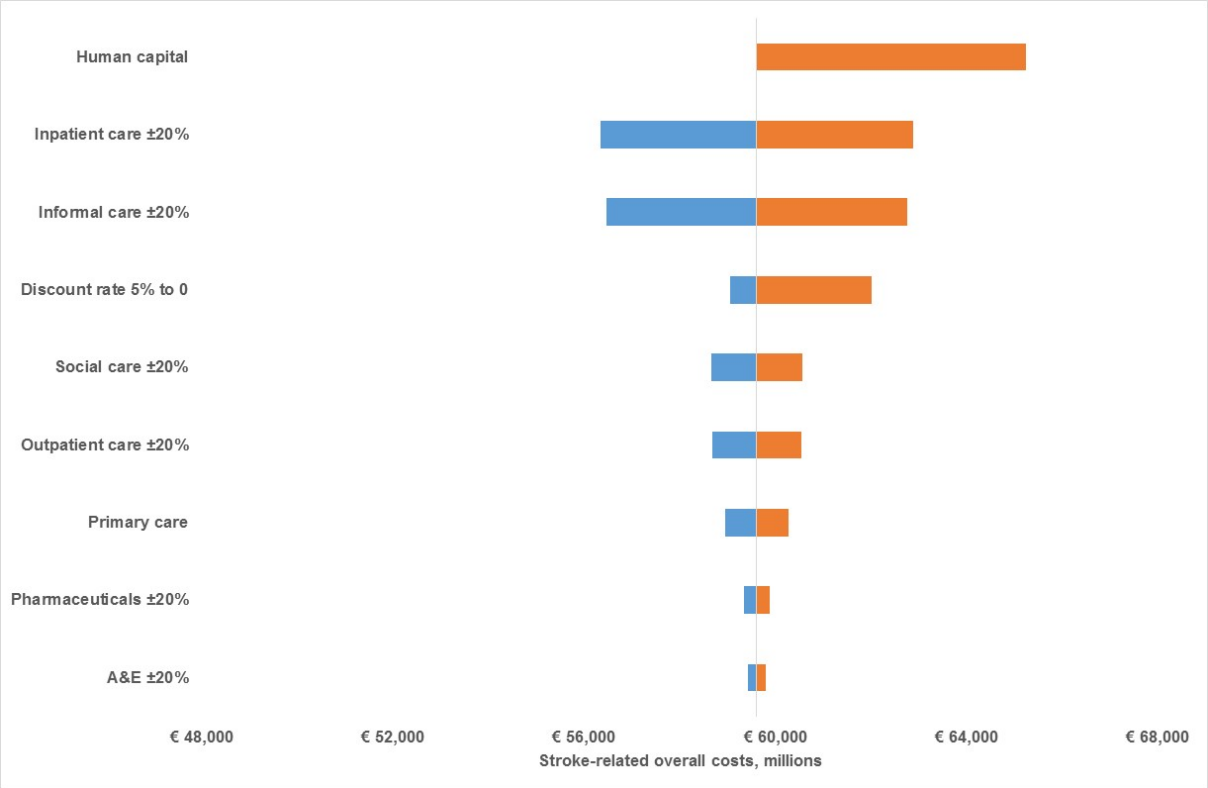


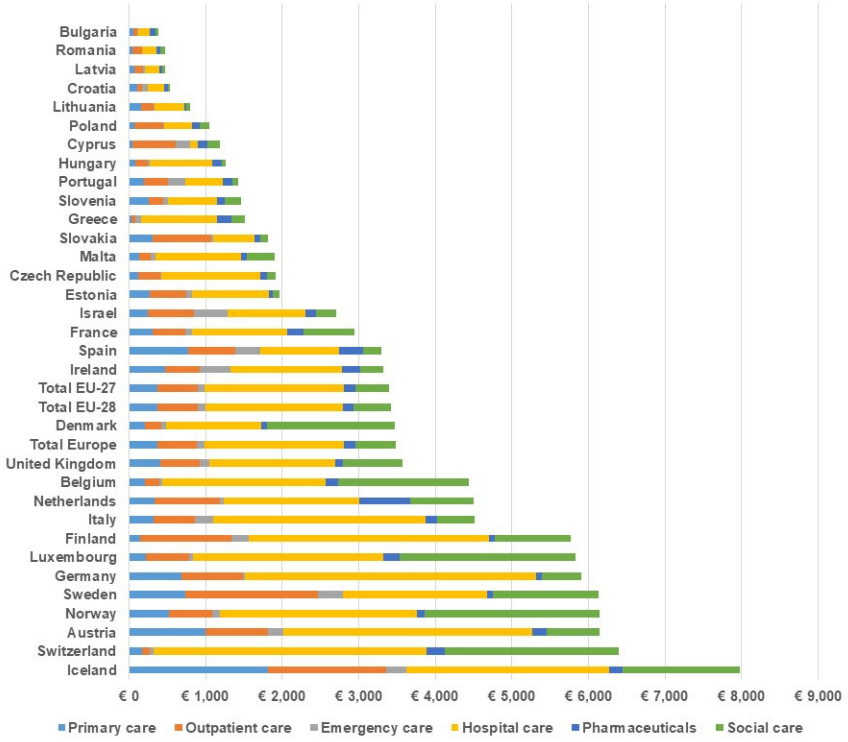
Table A8. Health and social care resource use, in thousands

	Number of GP visits	Number of outpatient visits	Number of emergency care visits	Days in hospital	Days in nursing home
Austria	2,841	1,830	188	858	784
Belgium	1,367	647	75	425	4,439
Bulgaria	1,791	486	55	329	658
Croatia	572	411	30	196	118
Cyprus	36	207	39	8	26
Czech Rep.	2,015	3,899	37	1,071	708
Denmark	943	224	43	74	634
Estonia	537	289	43	123	104
Finland	123	427	69	542	677
France	7,548	2,747	954	1,624	7,674
Germany	21,745	17,403	252	7,381	6,606
Greece	277	227	241	438	680
Hungary	3,829	5,414	49	1,164	711
Ireland	529	189	84	123	119
Italy	11,118	4,743	799	3,303	2,841
Latvia	392	209	27	141	208
Lithuania	1,140	528	42	262	545
Luxembourg	40	71	6	18	93
Malta	23	17	5	18	14
Netherlands	2,578	1,623	75	312	1,071
Poland	7,082	4,799	358	1,285	905
Portugal	1,188	894	458	292	493
Romania	2,040	4,413	51	920	2,340
Slovakia	1,451	2,358	85	280	346
Slovenia	392	200	20	76	139
Spain	10,860	2,584	960	797	1,449
Sweden	748	674	139	338	1,095
Total EU-27	83,206	57,510	5,185	22,397	35,476
UK	11,666	3,773	728	2,459	5,651
Total EU-28	94,872	61,283	5,912	24,855	41,128
Iceland	90	46	4	8	28
Israel	1,644	719	181	167	192
Norway	607	298	50	154	481
Switzerland	461	261	55	395	1,339
Total Europe	97,674	62,606	6,202	25,581	43,168

Table A9. Non-health and social care resource use, in thousands

	Hours of informal care	Deaths	Working years lost due to death	Working days lost due to illness
Austria	22,215	5	3	920
Belgium	21,128	7	3	770
Bulgaria	40,133	22	15	193
Croatia	21,541	7	3	421
Cyprus	1,255	0.4	0.3	54
Czech Rep.	35,784	10	7	507
Denmark	5,099	3	3	297
Estonia	5,837	1	1	362
Finland	4,743	4	2	832
France	86,846	32	19	7,648
Germany	270,850	57	39	5,191
Greece	21,982	14	5	889
Hungary	38,342	13	9	224
Ireland	4,726	2	2	507
Italy	169,878	62	21	3,199
Latvia	12,571	5	4	299
Lithuania	14,738	6	6	620
Luxembourg	828	0.2	0.1	16
Malta	895	0.3	0.2	50
Netherlands	27,764	10	7	548
Poland	90,924	30	33	604
Portugal	44,808	12	9	905
Romania	90,407	44	33	405
Slovakia	17,075	5	5	359
Slovenia	5,071	2	1	111
Spain	110,152	28	13	2,804
Sweden	9,301	6	3	568
Total EU-27	1,174,893	389	245	29,303
UK	116,847	40	34	5,705
Total EU-28	1,291,740	429	279	35,008
Iceland	158	0.2	0.2	22
Israel	10,272	2	3	1,551
Norway	2,922	3	2	1,149
Switzerland	6,157	4	3	267
Total Europe	1,311,249	438	286	37,997

Figure A2. Health and social care costs of stroke per person living with stroke across Europe in 2017, by care service category **A.** Not adjusted for price differentials. **B.** Adjusted for price differentials.



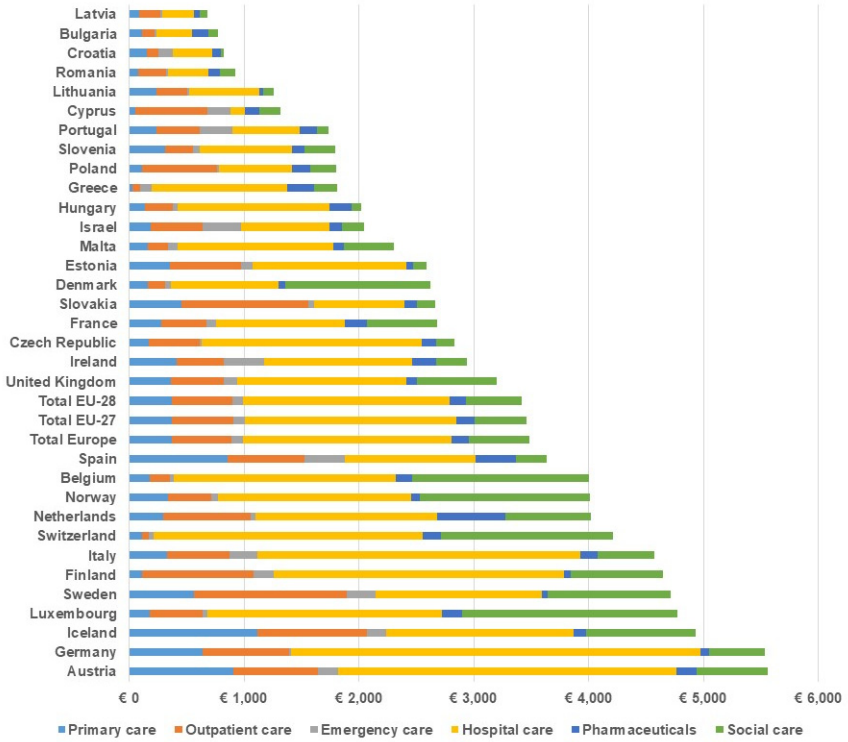
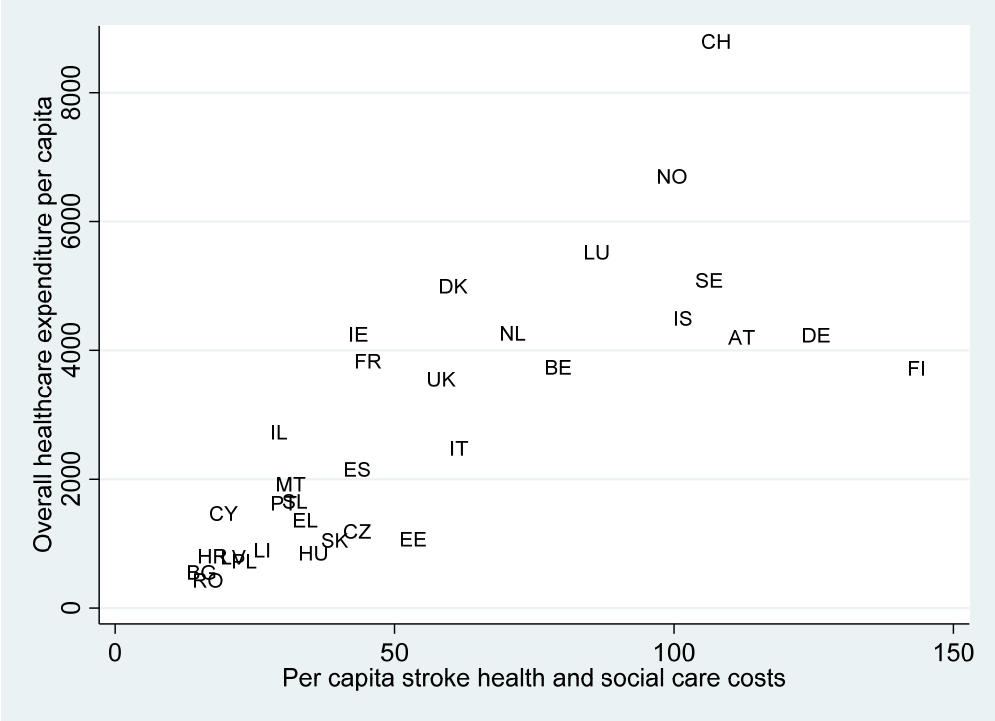


Figure A3. Correlation between stroke-related health and social care and health expenditure, €



AT: Austria, BE: Belgium, BG: Bulgaria, HR: Croatia, CY: Cyprus, CZ: Czech Republic, DK: Denmark, EE: Estonia, FI: Finland, FR: France, DE: Germany, EL: Greece, HU: Hungary, IS: Iceland, IE: Ireland, IL: Israel, IT, Italy, LV: Latvia, LI: Lithuania, LU: Luxembourg, MT: Malta, NL: the Netherlands, NO: Norway, PL: Poland, PT: Portugal, RO: Romania, SK: Slovakia, SL: Slovenia, ES: Spain, SE: Sweden, CH: Switzerland, UK: United Kingdom

Figure A4. Average annual hours of informal care provided for stroke patients severely limited in daily activities