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British Heart Foundation

Modelling the potential impact of a reduction in salt consumption on hypertension, coronary heart disease and stroke in the population of the United Kingdom from 2021 to 2035

Appendix 1
Data collection and processing

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Disease epidemiology

Disease epidemiology estimates are used as calibration targets for the microsimulation method, to confidently project further disease events. The diseases presented in this document reflect what was included in the BHF salt model. We carried out a review of existing sources which to our knowledge reflect the epidemiology of these diseases in the UK. The incidence, prevalence and mortality of ischaemic heart disease (IHD) and stroke were taken from the Institute of Health Metrics and Evaluation's (1) Global Burden of Disease (GBD) Results Tool (1). We refer to IHD as coronary heart disease (CHD) in the report.

The incidence, prevalence, and mortality of stroke includes ischaemic stroke, intracerebral haemorrhage and subarachnoid haemorrhage. The following ICD codes were included in the GBD analysis: G45-G46.8, I60-I62, I62.9-I64, I64.1, I65-I69.998, Z82.3. The incidence, prevalence, and mortality of CHD includes the following ICD codes: I20-I21.6, I21.9-I25.9, Z82.4-Z82.49.

Stroke incidence

Stroke Incidence per 100,000		
Age	Males	Females
0	8.237902	12.74584944
1-4	8.371119	12.91052198
5-9	8.088324	12.25322117
10-14	7.359173	10.75011544
15-19	6.681404	9.308923758
20-24	7.581664	10.11723492
25-29	10.02141	13.14514874
30-34	14.72755	18.81095357
35-39	21.73741	27.13729484
40-44	34.63639	38.79957056
45-49	53.56548	53.94610192
50-54	79.39889	72.1778895
55-59	112.2933	93.69434696
60-64	152.1316	125.9767339
65-69	198.5075	168.7090018
70-74	274.9083	262.5465286
75-79	383.697	409.8997459
80-84	581.0433	681.6767811
85-89	864.3803	1075.575302
90-94	1148.106	1469.768337
95+	1422.816	1858.160057

Stroke prevalence

Stroke prevalence per 100,000		
Age	Males	Females
0	0	0
1-4	0.692961	8.314977
5-9	30.33203	53.76582
10-14	51.11748	105.7431
15-19	86.05335	172.8687
20-24	118.4446	223.0333
25-29	160.6544	285.5331
30-34	218.3693	377.2139
35-39	314.9889	497.6293
40-44	458.4919	644.2354
45-49	652.4739	865.8448
50-54	931.6692	1123.819
55-59	1325.255	1434.365
60-64	1834.324	1812.699
65-69	2457.163	2334.45
70-74	3112.129	2996.397
75-79	3814.329	3838.153
80-84	4401.201	4754.043
85-89	4512.181	5497.914
90-94	4326.012	5855.89
95+	4102.556	5917.473

Stroke mortality

Stroke mortality per 100,000		
Age	Males	Females
0	0.332613	0.273565
1-4	0.054789	0.051555
5-9	0.04777	0.045307
10-14	0.088204	0.078968
15-19	0.281583	0.232949
20-24	0.632147	0.440106
25-29	1.248731	0.873026
30-34	2.014014	1.487854
35-39	3.154827	2.616199
40-44	5.425715	4.415599
45-49	8.382328	6.853107
50-54	13.42704	10.95623
55-59	21.99697	16.22364
60-64	36.18094	26.53052
65-69	62.60656	46.25685
70-74	128.8169	102.3908
75-79	271.1527	235.2807
80-84	575.1204	551.1467
85-89	1130.004	1173.206
90-94	2107.504	2302.312
95+	3424.023	4148.785

CHD incidence

CHD Incidence per 100,000		
Age	Males	Females
0-14	0	0
15-19	4.963705	6.5351
20-24	16.42323	20.67488
25-29	29.37625	35.8164
30-34	44.64748	37.78968
35-39	62.17577	26.59148
40-44	141.071	35.65731
45-49	281.5572	65.07965
50-54	466.6635	116.5685
55-59	696.0947	189.8604
60-64	893.2208	288.6138
65-69	1057.812	412.6383
70-74	1317.636	621.3791
75-79	1680.015	917.1469
80-84	2122.84	1296.711
85-89	2637.071	1752.843
90-94	2769.553	1964.925
95+	2516.736	1930.31

CHD prevalence

CHD prevalence per 100,000		
Age	Males	Females
0-14	0	0
15-19	15.63681	23.16377
20-24	37.00498	51.69847
25-29	107.2042	141.257
30-34	237.7743	281.957
35-39	451.778	415.8326
40-44	838.2473	564.9855
45-49	1644.462	815.1293
50-54	3045.197	1253.027
55-59	5137.73	1993.534
60-64	7871.109	3096.81
65-69	11749	4895.461
70-74	14990.73	6856.333
75-79	18169.25	9214.461
80-84	20016.08	11120.77
85-89	19311.89	11441.48
90-94	16661.48	10402.74
95+	13041.99	8380.723

CHD mortality

CHD mortality per 100,000		
Age	Males	Females
0-14	0	0
15-19	0.110723	0.051276
20-24	0.447864	0.128431
25-29	1.964267	0.327284
30-34	4.933119	0.940465
35-39	10.03058	2.16402
40-44	20.50266	4.370258
45-49	36.65288	8.420594
50-54	69.79922	16.2256
55-59	114.477	28.18345
60-64	182.2768	53.38294
65-69	274.7125	93.1322
70-74	439.3602	177.8339
75-79	721.6696	348.8005
80-84	1266.528	724.253
85-89	2192.49	1448.764
90-94	3759.992	2812.981
95+	6022.026	5086.695

Relative risks in the microsimulation

Increase in relative risk per 20 mmHg increase of systolic blood pressure from 115 mmHg (lognormal distribution)	
Parameter	Value
CHD: <50-year-old	0.49
CHD: 50 to 59-year-old	0.50
CHD: 60 to 69-year-old	0.54
CHD: 70 to 75-year-old	0.60
Stroke: <50-year-old	0.36
Stroke: 50 to 59-year-old	0.38
Stroke: 60 to 69-year-old	0.43
Stroke: 70 to 75-year-old	0.50

The relationship between salt and blood pressure

In the microsimulation, changes in systolic blood pressure (SBP) can be driven by modifications in salt consumption level. For individuals who are normotensive, SBP reduces by 2.42 mmHg per 4.4g reduction in salt intake per day. For individuals who are hypertensive, SBP reduces by 5.39 for every 4.4g reduction in salt intake per day (2). To account for the fact for the same reduction in salt intake, a greater fall in blood pressure is seen in older individuals (3), we assume that the population aged over 65 have the same fall in SBP with salt reduction as the hypertensive population (5.39 mmHg). Additionally, SBP increases by 0.06 mmHg for every year increase in age.

Health economics

Stroke costs include those who had a haemorrhagic or ischaemic stroke, from 12-24 months after the acute stroke event.

Cost of stroke

	Direct health cost (4)	Informal care (4)	Lost productivity (4)
Cost cited	£7759.00	£15345.00	£1666.00
Cost in 2021	£8770.51	£17345.47	£1883.19
Definition	Cost includes the National Health Service and Personal Social Services related costs after 12 months from diagnosis of the first stroke.	Lost hourly wage accounted for care provided by family or other unpaid carers, based on a national average hourly gross pay of £15.	The average value of income lost annually due to change or loss of employment
Population	Costs are calculated for those aged 40+ who have had a haemorrhagic or ischaemic stroke		

The costs of CHD were calculated from ICD 9 codes 410–414 and ICD10 codes I20–I25. The paper identifies the total cost of primary care, inpatient, outpatient, rehabilitation and social care for all CHD patients. The sum of the cost of doctor and nurse consultations, emergency department admissions, hospital inpatient and outpatient visits, rehabilitation, social care, prescriptions, and dispensing costs were divided by the number of patients with CHD in 1999 to obtain the direct healthcare cost per-patient. The indirect costs were also obtained by dividing the total cost of unpaid care and lost productivity (from morbidity) by the total number of patients with CHD in 1999.

Cost of CHD

	Direct health cost (5)	Unpaid care (5)	Lost productivity (5)
Cost cited	£643.68	£946.91	£865.01
Cost in 2021	£1034.12	£1455.43	£1329.54
Definition	Includes the cost of primary care, accident and emergency care, outpatient hospital care, inpatient and day-case hospital care, cardiac rehabilitation and drug treatment.	Lost hourly wage accounted for care provided by family or other unpaid carers. This was calculated for care provided by economically active carers (£8.32 per hour), and other carers (£5.73 per hour).	The average value of income lost annually due to change or loss of employment.
Population	Costs are calculated for those aged 16+		

Cost of hypertension

	Direct health cost for monitoring (6)	Direct health cost for treatment (7)	Social care (8)
Cost cited	£75.00	£57.20	£162.00
Cost in 2021	£324.66		
Definition	Annual cost of monitoring (including consultations and clinical tests) hypertension from the 12 months of diagnosis onwards.	The lower (conservative) average cost of hypertension treatment was taken. The cost is estimated from the use of the most common generic drug in each class, accounting for the proportion of people on different classes of drugs and those who are taking combination therapies.	Average cost of residential social care provided by the Council for a prevalent case of hypertension.

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