Public Health England

Protecting and improving the nation's health

Appendix 5. Imperial College Business School Data Sources

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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SUSTAINABLE
DEVELOPMENT GOALS

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1. Introduction

The main purpose of the project is to identify the direct costs associated with treatments and services for specific health conditions that are covered by public funds. We distinguish 5 different categories of health care and health care related costs: primary care costs, prescription costs, secondary inpatient costs, secondary outpatient costs, and social care costs. Additional types of care such as Accident and Emergency and ambulance costs are also extracted from the literature when available and are listed below, but are not taken into account in the microsimulation model. The main types of costs can be briefly defined as follows:

- Primary care is often the primary point of contact of someone seeking care. GP visits are the main source, but we have also included in the computation of the costs, when available, the different types of services offered by most of the GP practices. These include nurse visits, home visits, phone/email/fax consultations.
- Prescription costs are usually estimated as the volume times the costs of primary care prescription.
- Secondary inpatient costs are the total costs of treating a patient at hospital for a specific diagnosis (episode). They include day cases, elective and emergency admissions.
- Secondary outpatient costs capture the costs of visits to specialists.
- There are large variations in the definition of social care. They are due to the lack of the data and the need to rely on some proxy measures, and the lack of a clear definition of what counts as social care. Social care costs usually capture costs related to informal cares that are funded publicly.

We have not included in our different costs indirect costs such as the loss of income when hospitalised.

2. Summary of identified costs

Table 1 summarises the sources of costs used in the microsimulation. Secondary inpatient costs were estimated based on the Hospital and Episode Statistics (HES) data

that represents all NHS admissions. The rest of the costs were extracted from the literature.[1]

All the costs were adjusted using prevalence when necessary to represent the total cost per type of care and per disease group for England.

For the microsimulation model, we need the cost per case, that is the total cost divided by the prevalence in 2015. Therefore this figure is not necessarily equal to the unit cost as patients use different combinations and quantities of care.

We summarise below the total costs and unit costs per chronic disease and type of care, but only use the total costs of care in the microsimulation. We nevertheless looked at the unit costs as our original idea was to combine them with healthcare utilisation, but we could not estimate these figures for each health condition and type of care in the timeframe of this project.

Table 1 Summary of data sources used for type of care by chronic disease

	Stroke	Asthma	CHD	COPD	Dementia	Diabetes	Lung Cancer
Secondary inpatient	H	H	H	H	L	H	H
Secondary outpatient	L	L	L	L	L	L	L
Primary care	L	L	L	L	L	L	L
Prescriptions	L	L	L	L	L	L	L
Social care	L	L	L	L	L	L	L

Notes: H: hospital and episode statistics (HES); L: costs extracted from the literature;

Table 2 Summary of the unit costs identified in the literature per type of care by chronic disease

	Stroke	Asthma	CHD	COPD	Dementia	Diabetes	Lung Cancer
Ambulance	X	X		X	X		
Social Care	X	X	X	X	X	X	X
Secondary outpatient	X	X	X		X	X	X
Prescriptions	X		X		X	X	
A&E		X	X				

Notes: X: indicates chronic disease/type of care for which we have found a unit cost.

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[1] We also considered using the Programme Budgeting data, but were advised that it does not fully capture the actual health care expenditures, in particular for social care costs.

Relevant sources were collated using a systematic literature review with Mesh terms in PubMed, and completed using Google searches. While multiple studies from the search results were considered, the most relevant, recent studies were used for the final cost estimates. Table 1 provides an overview of the overall costs used in the microsimulation model per type of care. These costs were adjusted for inflation in 2015 to 16 using the Hospital and Community Health Services inflation index,[2] and divided by the prevalence in order to have a "cost per case".

Table 2 summarises all the relevant unit costs identified in the literature review. The unit costs should not be confused with the costs per case. The unit costs capture the average cost per patient who has used the relevant healthcare service, whereas the costs per case are the total costs divided by the disease prevalence.

The search terms are summarised in Table 3. The majority of search results were disregarded because they were theoretical, the cost breakdown was not granular enough or the figures were based on literature that had previously already been stated within the literature review. Papers which have been considered for the final cost estimate are listed in the consecutive tables, while it is also indicated which estimate was used for the final model. If the search with Mesh terms on PubMed returned no results, Google was consulted as a supporting search engine.

Studies which are recommended not to be used for the final model are highlighted in a grey font. If more than one study reported costs, the final cost estimate was chosen based on recency, definition of care and approach used. It was shown that bottom up approaches lead to more precise estimates. As such, this methodology was preferred over others.

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[2] Department of Health (2015.6 Pay & Price series.xls) "Hospital and Community Health Services (HCHS) pay and price inflation is a weighted average of two separate inflation indices, the Pay Cost Index (PCI) and the Health Service Cost Index (HSCI)"

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Table 3 MeSh search terms

Condition	Search term	Results found by PubMed	Ambulance	Social Care	Secondary outpatient	Secondary outpatient drugs	A&E
COPD	(("cost of disease"[MeSH Terms] OR "cost of illness"[MeSH Terms]) AND "pulmonary disease, chronic obstructive"[MeSH Terms]) AND "united kingdom"[MeSH Terms]	18	1	4			
Stroke	(((((cost of disease[MeSH Terms]) OR cost of illness[MeSH Terms]) AND acute stroke[MeSH Terms])) AND united kingdom[MeSH Terms]	22	1	4	2	1	0
Diabetes	(((((cost of disease[MeSH Terms]) OR cost of illness[MeSH Terms]) AND united kingdom[MeSH Terms])) AND Diabetes Mellitus[MeSH Terms]	38		3	2	1	
Asthma	(((((cost of disease[MeSH Terms]) OR cost of illness[MeSH Terms]) AND united kingdom[MeSH Terms])) AND Asthma[MeSH Terms]	19	1	3	1	0	2
CHD	(((((cost of disease[MeSH Terms]) OR cost of illness[MeSH Terms]) AND united kingdom[MeSH Terms])) AND coronary disease[MeSH Terms]	14		3	2	1	1
Lung Cancer	(((((cost of disease[MeSH Terms]) OR cost of illness[MeSH Terms]) AND united kingdom[MeSH Terms])) AND Lung Neoplasms	12		1	1		
Dementia	(((((cost of disease[MeSH Terms]) OR cost of illness[MeSH Terms]) AND united kingdom[MeSH Terms])) AND dementia[MeSH Terms]	65	1	3	1	1	0

3. Description of the overall costs extracted from the literature

We searched for peer-reviewed articles using PubMed. We also used Google to identify reports from other sources. We focused exclusively on costs based on English or UK data. We rarely had the choice between 2 references, but in this case our selection criteria were the transparency of the method to estimate the costs with a preference for bottom-up approaches,[3] the clarity of the methodology and definitions, the source of data with a preference for national representative samples, and the years for which the costs were reported.

3.1. Coronary Heart Diseases (CHD)

Coronary Heart Diseases (CHD) costs for secondary outpatient, prescriptions, primary care and social care come from *Liu et al. (2002*).[4] The authors report costs for 1999 (and prices are adjusted if necessary) for the UK.[5] The authors adopted a top-down approach to attribute the total expenditure to coronary heart disease from morbidity, mortality, and health service utilisation. The authors use Hospital Episode Statistics, and Health Survey for England, and also rely on other sources to estimate the overall costs by the different types of care.

3.2. Stroke

The costs for stroke come from Saka et al. 2009.[6] The authors choose a bottom-up approach, based on the South London Stroke Register (SLSR) and adjust for incidence and prevalence using data from the literature, and population figures from the Office for National Statistics. The authors provide a total 'diagnosis cost' (0.51% of total societal cost) although it is not clear where the diagnosis is made and why it is accounted for as a separated item. We have included this cost into the total secondary inpatient cost as most of the stroke patients will be admitted to hospital on the day of the stroke.

The authors do not have secondary outpatient data and therefore assume that secondary outpatient visits would happen within a year of being discharged, and would

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[3] A bottom-up approach, in contrast to a top-down approach, reflects the actual needs. It quantifies each resource required to provide the services or treatments to care for patients with a specific condition, multiplied by the input costs. A top-down approach allocates a total figure (e.g. the NHS programme budgeting cost) to different services as such is less likely to capture the actual spending associated with a specific disease.

[4] J. Liu, N. Maniadakis, A. Gray, and M. Rayner. "The Economic Burden of Coronary Heart Disease in the UK." Heart 2002; 88: 597–603.

[5] "National Health Service costs were adjusted to 1999 prices using the hospital and community health services pay and prices inflation index for NHS costs, while productivity and informal care costs were adjusted using the average earnings index" p. 597 (Liu et al. 2002).

[6] O. Saka, A. McGuire, and C. Wolf. Cost of Stroke in the United Kingdom. Age and Ageing, 2009; 38: 27–32.

consist of 2 visits to a stroke specialist clinic, and one visit to the GP. These secondary outpatient costs are reported as a single figure, we therefore allocate 2/3 of the overall secondary outpatient cost to 'outpatient care' and 1/3 to 'primary care'.

The social care costs are proxied by the community services, which combine stays in nursing, residential, and sheltered homes from the same reference.

3.3. Diabetes, type 2

Hex et al. (2012)[7] adopt a top-down approach to estimate the costs of diabetes for 2010/11 in the UK. We extract primary care and prescription costs form this reference but it should be said that the authors' approach is not perfectly clear. The data source is not explicit, the selections' criteria of the patient and diagnostic codes are not listed, and the article refers once to *excess* primary care consultations although the cost reported in the table refers to primary care cost only. Yet, we did not find any other suitable source.

The other 2 references estimating the cost of diabetes for the other types of care are not from peer-reviewed journals, but this is what is available to the best of our knowledge.

The secondary inpatient and secondary outpatient costs for diabetes type 2 come from a working paper by Kanavos et al. (2012),[8] and was funded by an unrestricted educational grant from Novo Nordisk. As part of their study, the authors also analyse France, Germany, Italy and Spain. The authors rely on 2 published studies to derive their secondary outpatient costs in the UK, namely Currie et al. (2010)[9] and Morgan et al. (2010).[10] They combine the two to create an annual per patient cost and input them into an APHO Prevalence Modelling data to arrive at total expenditure figures; extrapolation to 2010 was achieved by using the GDP deflator (Kanavos et al. 2010, p.16). The main weakness of this reference is that the selection criteria of the patients suffering from diabetes and its related complications is not explicit, and the estimated costs are generally high compare to Hex et al. (2012) but relatively average compared to the other countries analysed in this study (Kanavos et al., 2012, p.51).

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[7] N. Hex, C. Bartlett, M. Taylor, and D. Varley. Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. Diabetic Medicine, 2012.

[8] P. Kanavos, S. van den Aardweg, and W. Schurer. Diabetes expenditure, burden of disease and management in 5 EU countries. 2012. LSE Health, London School of Economics.

[9] Currie, CJ, EA Gale, and CD Poole. 2010. Estimation of primary care treatment costs and treatment efficacy for people with Type 1 and Type 2 diabetes in the United Kingdom from 1997 to 2007. Diab Med 27 (8):938-948.

[10] Morgan, C, J Peters, S Dixon, and C Currie. 2010. Estimates costs of acute hospital care for people with diabetes in the United Kingdom: a routine record linkage study in a large region. Diabetic Medicine 27:1066- 1073.

The social care cost for diabetes type 2 comes from a report by the Institute of Diabetes for Older People (IDOP) and Novo Nordisk Ltd.[11] They combine different sources of data. The number of people in social care settings with diabetes was calculated by using local authority prevalence data from the Yorkshire and Humber Public Health Observatory (YHPHO) and local authority social care population data from the Health and Social Care Information Centre (HSCIC) as part of Personal Social Services Expenditure data. They estimate that the total cost to local authorities of providing care for people in residential, nursing and home care settings in 2011/12 was £11.3 billion. Yet, the sources of data are not clear. The report also states "Across England […] caring for people with diabetes in social care settings costs £1.442 billion" (UK/DB/1113/0509, p.13). We adjusted this figure by retaining 90% of the costs to reflect individuals suffering from diabetes type 2 only (UK/DB/1113/0509, p.3).

3.4. Asthma

The costs of asthma for the whole population in the UK come from Mukherjee et al. (2016).[12] This is the most complete source of cost information reviewed in this project, and even has a preliminary paper detailing the research protocol.[13] The authors have obtained and analysed asthma-relevant data from 27 datasets, of which 5 were linked: these comprised national health surveys for 2010/11, and routine administrative, health and social care datasets for 2011/12; 2011/12 costs were estimated in pounds sterling using economic modelling. The authors report the costs for the UK as well as for the different member countries, for the financial year 2011/12, adjusting them for inflation if necessary.

Secondary inpatient costs for England were calculated based on Hospital Episode Statistics for England and are accounted for when asthma is the primary reason for care. We report for secondary inpatient costs the sum of secondary inpatient, day-case, and intensive care unit episodes for asthma. The authors identify asthmatic patient in HES when having a primary diagnosis of asthma with ICD-10 code of J45 for asthma or J46 for status asthmatics at discharge from hospital.[14]

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[11] Institute of Diabetes for Older People (IDOP) and Novo Nordisk Ltd. "The Hidden Impact of Diabetes in Social Care" published in 2013 by UK Public Affairs UK/DB/1113/0509.

[12] M. Mukherjee, A.Stoddart, R. Gupta3, B. Nwaru, A. Farr, M. Heaven, D. Fitzsimmons, A. Bandyopadhyay, C. Aftab, C. Simpson, R. Lyons, C. Fischbacher, C. Dibben, M. Shields, C. Phillips, D. Strachan, G. Davies, B. McKinstry and A. Sheikh. The epidemiology, healthcare and societal burden and costs of asthma in the UK and its member nations: analyses of standalone and linked national databases. BMC Medicine, 2016; 14:113.

[13] Mukherjee M, Gupta R, Farr A, et al. Estimating the incidence, prevalence and true cost of asthma in the UK: secondary analysis of national stand-alone and linked databases in England, Northern Ireland, Scotland and Wales— a study protocol. BMJ Open 2014;4:e006647. doi:10.1136/bmjopen-2014- 006647

[14] We define inpatient admissions due to asthma when the primary diagnosis is ICD-10=J45. Some of these admissions could be related to COPD which we have voluntarily kept separated.

Primary care costs include GP and nurse consultations, as well as out-of-hours calls. Their prevalence relies on the Weekly Returns Service (WRS) of the Royal College of General Practitioners, and visits were selected based on Read codes (cf. the article's appendices 2 and 3 for the full list of codes). GP based prescriptions where extracted based on their British National Formulary (BNF) (cf. the article's appendix 4 for the full list of BNF codes).

The authors also estimate ambulance trips related to asthma.

The major limitation of this study however is that they do not report secondary outpatient costs. The authors had routine data on attendances in NHS secondary outpatient clinics, but these were captured under the broader heading of 'respiratory' consultations and it was therefore not possible to estimate the proportions of these consultations that were particularly for asthma. In general, the authors acknowledge the coding of asthma may not be systematic and therefore their costs represent a 'minimum likely financial costs to the UK public sector'. Yet, their estimated primary and secondary care costs are much higher than the NHS Programme Budget data.

We found a systematic review of the cost of asthma (Bahadori et al. 2009[15]), but the secondary outpatient cost is never greatly detailed. Bahadori et al. (2009) suggest that secondary outpatient cost in the case of asthma is a predominant proportion of the overall costs (for the other countries analysed). This contradicts Neville et al. (2003)[16] who study the cost of asthma in Scotland. Their sample had 1,029 secondary outpatient visits among all 9,467 asthmatic patients. We therefore proxy the number of secondary outpatient visits assuming that 10.9% (1,029/9,467=0.109) of asthmatic patients have an secondary outpatient visit per year. We multiply this figure by the national average (£112) for secondary outpatient attendances provided by PSSRU.[17]

The social care cost of asthma comes from a study by Georghiou et al. (2012)[18] commissioned by the National End of Life Care Intelligence Network, which builds on an earlier piece of work (Bardsley et al., 2010)[19] to create and analyse the largest linked health and social care dataset in England. The authors use data from 7 sites from

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[15] K. Bahadori, M. Doyle-Water, C. Marra, L. Lynd, K. Alasaly, J. Swiston, and J. FitzGerald. Economic burden of asthma: a systematic review. BMC Pulmonary Medicine 2009, 9:24.

[16] R. Neville, G. Hoskins, B. Smith, and C. McCowan. The Economic and Humand Costs of Astham in Scotland. Primary Care Respiratory Journal. 2003; 12(4)115-119.

[17] PSSRU, "Unit Costs of Health & Social Care 2015". http://www.pssru.ac.uk/pub/uc/uc2015/full.pdf accessed on November 2017.

[18] T. Georghiou, S. Davies, A. Davies, and M. Bardsley. Understanding patterns of health and social care at the end of life. London: Nuffield Trust, 2012 (costs reported on p.46.).

[19] M. Bardsley, T. Georghiou, and J. Dixon (2010) Social Care Cost at the end of life. London: Nuffield Trust.

individuals at the end of their life (in the last 12 months), and adopted a bottom-up approach. "Each individual's secondary inpatient history was scanned for 2 years prior to death to identify all the diagnoses in their records. These diagnoses were used to map the individual into one or more of 25 disease groupings (cancer, COPD, etc.). Each of these disease groupings was analysed for associated levels of social care use". From their 73,243 deceased individuals sample size, 3,480 had a prior asthma diagnosis. They include in their definition of social care home, residential and nursing care, meals, day care, direct payments, equipment and adaptations, respite, other accommodation costs, and exclude basements costs. The authors cost each service using an indicative cost of social care and are confident to report a valid order of magnitude overall although they may underestimate or overestimate some specific services. The data was collected between January 2007 and March 2010. We assume that the costs are reported for 2009, but this is not explicit in the report.

We originally intended to estimate the healthcare cost of asthma separated between children and adults. The only reference we found analysing asthma related health care expenditure for children is Stevens et al. (2003).[20] The authors adopt a bottom-up approach, and derived their costs based on a sample of 94 preschool children (18 months to 5 years old) who attended hospital with a primary diagnosis of wheeze or asthma during 1998/99. Estimates of health service costs for the 0.88% of the UK preschool population admitted to secondary care are based on mean healthcare costs from the present sample. This assumes that health care resource use in this sample approximates to that of all families in the UK with a child hospitalized due to wheezing. We believe that it is better to use the costs for asthma covering the whole population from more recent sources that are well documented in this case. Furthermore, Stevens et al. (2003) only cover pre-school children, and the age group between 6 and 18 years old would still need to be extrapolated.

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[20] C. Stevens, D. Turner, C. Kuehni, J. Couriel, and M. Silverman. The economic impact of preschool asthma and wheeze. European Respiratory Journal, 2003:21(6), pp.1000-1006.

3.5. COPD

Guest (1999)[21] estimates the health care costs related to COPD broken down by the different categories of care that we are interested in. The obvious limitation is that the costs are reported for 1996/97 using health care treatments provided in 1992/93, and the type of treatments and their costs may have significantly changed over the last 20 years. Yet, to the best of our knowledge, the only source of information available for the breakdown of care we need for England. Guest (1999) relies on 3 datasets capturing NHS resources: Medical Data Index database,[22] Medicare Audits Ltd,[23] and Hospital Episode Statistics, and supplemented it with a small sample of telephone interviews. The author does not describe the selection sample criteria's and process for the telephone surveys. Costs are from national published unit resource costs at 1996/97 prices, adjusted when not available for this year by the Health Service Inflation Index. Resources utilisation related to COPD is based on ICD-9 codes 490-492 and 494-496.

The social care cost of COPD is extracted from Georghiou et al. (2012)[18] and suffers from the same limitations discussed previously in the cases of diabetes and asthma, namely only cover the last 12 months of life.

3.6. Lung Cancer

Estimating the cost of lung cancer is complex due to the large cost variation depending on the stage of cancer at the time of the diagnosis, and also the treatment received prior to death (e.g. curative vs. palliative). Our cost estimates only capture palliative care. Guest et al. (2005)[24] combine different references and sources of data, and identify patients based on Read codes to estimate the costs of lung cancer patients from the time they started strong opioid treatment until death (palliative treatment). The mean life expectancy of lung cancer patients in their sample from diagnosis to death was 0.7 year, with a mean palliative care length of 180 days. As the costs are only reported as average per patient, and we multiply them by the number of annual deaths due to lung cancer to obtain the total costs.

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[21] J. Guest. The annual cost of chronic obstructive pulmonary disease to the UK's National Health Service. Disease Management and Health Outcomes. 1999;5(2):93–100.

[22] It is not specified how big this dataset is nor how representative it is for the whole population, but it allows the authors to assume that 6.5 million patients were suffering from COPD and 16.2 GP consultations were associated with this condition in 1992/93.

[23] The information coming from this source is not explained in the article.

[24] J. Guest, F. Ruiz, M. Greener, et al. Palliative care treatment patterns and associated costs of healthcare resource use for specific advanced cancer patients in the UK. Eur J Cancer Care 2006; 15(1): 65–73.

The costs therefore are underestimated. However, lung cancer has a low-survival rate after diagnosis, 30% only at one year according to Cancer Research UK,[25] suggesting that the cost estimates represent the large majority of the cases. Nevertheless, the limitations of the costs are that they do not account for curative care and do not take into account cancer survivors, although these cases represent only a minority for this type of cancer.

Social care costs are extracted from Georghiou et al. (2012),[18] also used in the case of asthma. The main limitations are that the cost of social care for lung cancer is for all types of cancer, and that social care cost is only estimated over the last 12 months of life. As a result it represents the cost per death, instead of the yearly cost of social care for patients with lung cancer who die and the ones who survive.

We considered Round et al. (2015)[26] as a more recent reference, but their approach combines different studies, including Guest et al. (2006) and Georghiou et al. (2012),[18] and use Monte Carlo simulations to generate expected patient mean costs. We therefore preferred the original references.

3.7. Dementia

We cannot rely on HES estimates for dementia, as they do not include care in special institutions. We therefore solely rely on the literature for this health condition. Dementia costs are extracted from Luengo-Fernandez et al. (2010).[27] The report is produced by the Health Economics Research Centre, University of Oxford for the Alzheimer's Research Trust. The approach adopted in this report is similar to Luengo-Fernandez (2006)[28] among others, used in the case of CVD, and the figures also rely on other studies such as Wolstenholme et al (2002).[29] The costs are estimated using a top-down approach and updated to 2008 costs. The data sources include among others Hospital Episode Statistics (HES), the Labour Force Survey (LFS), and the Annual Survey of Hours and Earnings (ASHE). Costs of anti-dementia medications were derived from the Prescription Cost Analysis (PCA).

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[25] Cancer Research UK, http://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/lung-cancer/survival#heading-Zero, Accessed on October 2017.

[26] Round, Jones, and Morris. Estimating the cost of caring for people with cancer at the end of life: A modelling study. Palliative Medicine, 2015, 29(10), pp.899-907.

[27] Luengo-Fernandez, Leal and Gray. Dementia 2010: The economic burden of dementia and associated research funding in the United Kingdom. Alzheimer's Research Trust. 2010.

[28] Luengo-Fernandez R, Leal J, Gray A, Petersen S, Rayner M. Cost of cardiovascular diseases in the United Kingdom. Heart 2006;92:1384-9.

[29] Wolstenholme J, Fenn P, Gray A, Keene J, Jacoby R, Hope T. Estimating the relationship between disease progression and cost of care in dementia. British Journal of Psychiatry 2002;2002:36-42.

The GP costs include nurse home visits, nurse surgery visits, home visits, GP surgery visits, and GP telephone visits. Secondary inpatient costs are the sum of hospital bed-days, and hospital day cases. Social care cost includes nursing and residential care homes, and do not include the population below 65 years old.

Luengo-Fernandez et al. estimate the social care cost related to dementia at about £10.1 billion (adjusted for inflation in 2015), however, the authors cannot distinguish between privately and publicly funded sources. The Alzheimer's Society 2014 report estimates the share of publicly funded social care costs to be about half the total social care bill.[30] The Alzheimer's Society adopts a different approach and the results are not directly comparable, but we use their proportion to provide a conservative estimate of publicly funded social care costs. Therefore we divided by 2 the £10.1 billion estimate from Luengo-Fernandez et al. to ensure we are capturing on the publicly funded social care costs.

Evidence from the literature is extremely limited. Luengo-Fernandez et al.'s report is the most detailed source available but suffers from some limitations. The main limitations are that it is not from a peer-reviewed publication, it also relies on other publications, and the methodology is not always clear. For example, most of the costs seem to be reported for 2008, but parts of the report also refer to 2007/08.

3.8. Limitations

The main overall limitation of using costs from the literature is that the estimation methods vary significantly from one paper to another, and the inputs for each category of care are slightly different for each condition. When the estimates come from a bottom-up approach, the costs are likely to underestimate the true costs as the possible missing components are set to zero. When the estimates come from a top-down approach, the allocation rule is often not clear and it is hard to know how comparable they are to the true cost. Yet, the order of magnitude is likely to represent the true costs for the NHS, as the overall costs are broken down into parts. Furthermore, the authors often argue that their method is conservative and that the estimated costs represent lower-bound estimates.

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[30] The publicly social care costs were about £4.5 billion out of a total of £10.3 billion in 2013.

4. Comparison of the different unit costs identified by disease

The following sections describe the unit cost data that has been identified by the following diseases: stroke; asthma; coronary heart disease (CHD); chronic obstructive pulmonary disease (COPD); dementia; diabetes; lung cancer and cardiovascular diseases. The non-greyed out references are the most detailed ones.

This is reported only as a reference, as the final approach adopted in the report is to use overall cost per disease and type of care, and divide them by the prevalence to obtain a cost per case.

4.1. Stroke

Condition	Reference	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Description
Ambulance	[36]	Calls: £7 Hear and treat and refer: £36 See and treat and refer (including carbon 30 kgCO$_2$e): £184 See and treat and convey[31] (including carbon 39 kgCO$_2$e): £283 All Ambulance Services: £98	2014/15 (already uprated for inflation); 2016	This cost estimate is reported by the *NHS Trust and Primary Care Trusts*. The estimate has been uprated to 2015/16 levels using the HCHS pay & prices inflator. These prices are not specifically reported for stroke. However, they have been used in another paper on stroke [34].
Social Care	[1]	£3,513.60	2001/2002; 2003	You man et al researched the cost of treating stroke in the UK. The 5-year cost estimate of social care is based on data from a randomised, controlled trial including 457 acute stroke patients. Costs were based on standard costs as published by the Personal Social Services Research Unit (PSSRU). The data was reported for a 5-year period. The average of the 5-year costs is reported. The initial cost data was reported in 2002 and is therefore adjusted for inflation. Social care was defined by the hours of caregiver support.

[31] These are the national currencies for ambulance services.

				The paper refers to 'informal care'.
	[15]	£12,121.55 (indirect costs) £10,774 (informal care costs)	2005; 2009	A second study by Saka et al. employed a bottom up approach. Within this study, stroke was defined as an 'incident stroke' corresponding to ICD10 codes I60 – 66 (10th revision). Annual indirect costs were defined as 'loss of earnings attributable to premature mortality due to stroke'. Informal care costs are defined as the time spent by carers of disabled stroke patients. The difference between professional help and help from friends or family was accounted for. The paper reported these estimates per population and summarised the costs for the whole population that had a stroke (200,000). As such, the number of individuals who had a stroke divided the cost.
	[21]	£1235 – 1471 (social services) £221 – 258 (other community based care) £884 – 933 (informal care)	2002	This study used 300 patients and caregivers to evaluate the economic impact of caregiver training. 300 patients were considered for the study. The first estimate reported on the left shows the cost estimate for trained caregivers, while the second estimate presents the cost of non-trained caregivers. The estimates were made based on minimum wage. A bottom up approach was used. Social services refer to: personal care, domestic assistance, carelink, laundry assistance, shopping assistance, and meals on wheels, day care visits. Other community based care refers to: GP in surgery, GP at patient's home, district nurse at patient's home, dentist, optician, chiropody in clinic/home, respite care (in weeks). Informal care refers to the value of the opportunities forgone by caregivers as a result of time spent on care giving.

	[22]	£8321 (short term costs for 12 week period after stroke incidence)	1998; 1999	Caro et al did a study on predicting long-term costs of stroke patients. The research showed that there are significant differences between the costs within 12 weeks after the incidence and the accumulated costs until the end of life. Social care or indirect total costs that accumulate until the end of life were not reported. The cost estimate on the left considers social care within the first 12 weeks after the incidence only. To find the cost estimates, a 'stroke treatment economic model' was created.
Secondary outpatient	[34]	£135 weighted average of all secondary outpatient attendances £136 weighted average of all secondary outpatient attendances (inc. carbon 28 kgCO$_2$e)	2014/15 (already uprated for inflation); 2016	Similarly, to the ambulance cost estimate, this cost estimate is not specifically reported for stroke patients.
	[37]	£168 First secondary outpatient attendance		These costs were identified by the NHS and were defined as follows: A patient attends an NHS trust for a first secondary outpatient attendance, which has a national price of £168. The NHS trust has an MFF payment index[32] value of 1.0461. The income that the trust receives from the commissioner for this secondary outpatient attendance is £176 (£168 x 1.0461). As such, this cost estimate does not exclusively refer to stroke patients.

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[32] National prices are calculated on the basis of average costs and do not take into account some features of cost that are likely to vary across the country. The purpose of the market forces factor (MFF) is to compensate providers for the cost differences of providing healthcare in different parts of the country. Many of these cost differences are driven by geographical variation in land, labour and building costs, which cannot be avoided by NHS providers, and therefore a variation to a single national price is needed.

Appendix 5. Imperial College Business School Data Sources

Prescription	[35]	£35.6 per month	Adjusted for 2005 prices; 2009	The cost was firstly reported by the British Medical Association and the Royal Pharmaceutical Society of Great Britain[33]. The study used a bottom-up approach.

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[33] British National Formulary 48, September 2004. British Medical Association and the Royal Pharmaceutical Society of Great Britain.

4.2. Asthma

Cost	Reference	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Description
Ambulance	[15]	Ambulance conveyance: £33,172,000 (per year for total prevalence of 112,900) Derived cost: £293.82	2011/12; 2016	The study quotes that the usage of ambulance service due to asthma could not reliably be estimated from England, Wales and Northern Island. As such, this was identified as a data gap. However, data was available from the Scottish Ambulance Service. This was a secondary analyses of national health surveys, primary and secondary National Health Service datasets and national administrative data. 27 datasets were used to derive incidence, prevalence and cost figures. Costs were adjusted applying inflation indices where required.
A&E	[27]	A&E attendances: £11 (+/- 0.12) * 0.36 (+/- 1.71)	1999	Data was collected at the Leicester Royal Infirmary and represents costs related to children treatment (18months to 5 years) only.
	[15]	Attendances: 121,000 Accident and emergency cases: £13,101,000 Derived cost: £108.27 per patient who used A&E	2011/12; 2016	This was a secondary analyses of national health surveys, primary and secondary National Health Service datasets and national administrative data. 27 datasets were used to derive incidence, prevalence and cost figures. Costs were adjusted applying inflation indices where required.

	[16]	CHF 1,019 (adults) CHF 30 (children)	1997; 1999	This study was conducted in Switzerland and involved 589 patients. Indirect costs were defined as costs arising from morbidity and mortality. The study was conducted using a bottom up approach.
	[4]	£2,567.00	2009; 2012	Again, the Nuffield Trust study was used to estimate social care costs for Asthma patients.
Social Care	[23]	£7885 – 8074 (male, latex or glutaraldehyde) £4444 – 4590 (female, latex or glutaraldehyde) £4967 – 5123 (male, isocyanates) £3678 – 3817 (female, isocyanates) £4476 – 4624 (male, flour or grain) £3507 – 3643 (female, flour or grain)	2004; 2011	In this study, indirect costs comprise lost income and 'human costs' from the pain and suffering experienced by affected workers. The cost estimates were made for the most common allergies.

	[27]	See screenshot below This paper reports cost estimates per appointment: £113 (new patient) £56 (existing patient)	1998/99; 2002	Cost estimates were made for children (18 months to 5 years old) patients only using a bottom up approach. All costs are per appointment.
Secondary outpatient costs				

Table 1. – Annual family-borne, nonwaged and waged time lost, and health-service costs for 94 trial families

	Events n Total mean	Family-borne GBP	Nonwaged time GBP	Waged time GBP	Health service GBP
Illness at home	52±0.55			9.93[#]	
GP consultations	452±4.81				103.00±81.26;
		2.81±6.13[¶];	25.08±67.18[¶];	6.61±16.95[¶];	80.00 (0–283.8)
Practice nurse consultations	53±0.56	0.95 (0–20.59)	10.43 (0–110.82)	0 (0–59.41)	5.15±16.77;
					0 (0–27.42)
Prescription items	605±6.44				26.62±25.79;
					19.26 (0–97.21)
A&E attendances	11±0.12	0.36±1.71;	2.09±13.62;	0.70±4.42;	4.10±12.42;
		0 (0–6.64)	0 (0–21.53)	0 (0–3.19)	0 (0–35.00)
Inpatient days	61±0.65	10.08±39.30;	16.20±47.87;	32.11±185.75;	243.17±451.93;
		0 (0–63.00)	0 (0–160.33)	0 (0–242.56)	0 (0–1604.00)
Outpatient attendances	78±0.83	3.68±7.88;	3.19±9.37;	5.67±15.91;	46.47±66.02;
		0 (0–22.34)	0 (0–37.56)	0 (0–53.09)	0 (0–224.00)
Regular family expenditure		14.94±43.27;			
		0 (0–168.3)			
Total		31.86±43.27;	46.57±92.30;	55.02±218.77;	428.51±510.39;
		6.46 (0–219.37)	17.89 (0–201.21)	0 (0–356.86)	178.33 (34.07–1781.89)

Data are presented as mean±SD and median (95% confidence interval). GBP: UK pounds; GP: general practitioner; A&E: accident and emergency department. [#]: single event; [¶]: general practitioner and practice nurse consultations costed together.

Notes: The table comes from reference [27].

4.3   CHD

Cost	Reference	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Description
Social Care	[8]	£124.00 (Community Care)[34] £ 38.00 (Care provided in other setting)[35]	2012/13	These cost estimates are computed based on a programme budgeting tool by the NHS England. Data were reported in 2012/13. The source does not provide further information on the study population. Assuming that the costs were reported for all patients with some condition of CHD, the total estimate was divided by the number of CHD patients in the respective year.
	[25]	£2,203.71	2004; 2006	This study employed a top-down approach using prevalence data from national level.
	[26]	£2,488.56	2005; 2009	The base estimate for indirect costs was taken from luengo-Fernandez et al. estimate [25]. However, the cost was inflated and is therefore to be considered as well.

[34] Care delivered outside of a hospital and within local communities. Secondary inpatient and outpatient activity carried out within community hospitals should be classified as secondary care activity. All other activity carried out in community hospitals should be classified as community care.

[35] All other health and social care services which are not included within the other health settings. Includes prison healthcare, nursing homes, hospice care. Continuing care, intermediate care, respite care, free nursing care should be included within this setting. Social care and learning disability services should be included within this setting unless otherwise specified by the mappings.

Secondary outpatient	[29]	£202 secondary outpatient procedure tariff £188 average secondary outpatient attendance tariff	2012/13	Cost estimates are based on submissions from Area Teams in 2014 made up of 2012/13 Secondary User Services (SUS) Payment by Results (PbR) data. The data modelling relied on the assumption that there is one secondary outpatient attendance for every 9 secondary inpatient spells. The secondary outpatient procedure tariff included costs for minor cardiac procedures, complex echocardiogram (including congenital, transoesophageal and fetal echocardiography) and electrocardiogram monitoring and stress testing. The secondary outpatient attendance tariff took into account the admission to cardiac surgery, cardiology and paediatric cardiology with reference to the first or follow up attendance with a single or multiple professionals.
	[40]	£72.79 average cost per unit	1999;2002	"Direct health care cost estimates were obtained by assessing the value of resources used by the NHS and other government services to prevent, detect, and treat coronary heart disease and to provide cardiac rehabilitation programmes. The resource quantities used in the health services were derived from the sources mentioned above."
A & E	[40]	£55.60 average cost per unit	1999;2002	"Direct health care cost estimates were obtained by assessing the value of resources used by the NHS and other government services to prevent, detect, and treat coronary heart disease and to provide cardiac rehabilitation programmes. The resource quantities used in the health services were derived from the sources mentioned above."
Prescriptions	[40]	£8.90 (Prescriptions) £1.54 (Dispensing)	1999;2002	

4.4 COPD

Condition	Reference	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Description
Ambulance	[31]	£52 per emergency clinic visit	1997/98; 2001	Chronic bronchitis is classified as a COPD. The cost was estimated using a bottom up approach. Costs were based on NHS Trusts.
Social Care	[4]	£2,602.00	2009; 2012	Again, the Nuffield Trust study was used to estimate social care costs for COPD patients.
	[17]	$15,579 per patient	2013; 2016	Foo et al. defined indirect costs as the value of lost productivity. A bottom up approach was employed. All patients were adults at the age of 40 or above. In order to evaluate the indirect costs of COPD, Foo et al used the Work Productivity and Activity Impairment scale accounting for the work loss values. The costs were estimated using the friction cost method. Even though the cost estimate is reported in USD it is still highly relevant as a survey was sent out to patients in the UK.
	[18]	£399 (mild) £202 (moderate) £2331 (severe)	2000; 2006	Halpin did an extensive literature review on costs associated with COPD. Indirect cost estimates that were reported in this study include the costs of lost productivity (excluding costs of social security payments or other monetary benefits paid to patients or carers). The study that first reported the results employed a bottom up approach [19]. The estimate is not to be used as a more recent study is available.
	[20]	£819.66	2003; 2006	The indirect cost estimate relies on the same reference as above, but reports the weighted average for any patient. The estimate is not to be used as a more recent study is available.

4.5   Dementia

Cost	Reference	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Description
Ambulance	[28]	£112 (average unit cost)	2008;2010	The unit cost for the cost estimation was reported from the NHS Reference Cost Schedule 2007/08, but adjusted for inflation for the purpose of the paper.
Social Care	[5]	£5,362 (mild) £21,455 (moderate) £22,176 (severe) £12,584.00 (all severity levels)	2013; 2013	The estimates were published by the Alzheimer's Society in the Dementia UK Update Report in 2014. An Expert Delphi Consensus was used to produce estimates of the prevalence of dementia using existing research data. All phases within this methodology were reviewed by an expert panel. Social care was not further defined within this report.
	[23]	€1325.6 (1,519) (mild, total societal costs) per month €1,884.1 (1972.5) (mild, total societal costs) per	2010; 2016	Total societal costs were calculated using an opportunity cost approach taking into account productivity loss for working age caregivers and lost leisure time for retired people. Total societal costs = patient healthcare and social care costs + caregiver informal care cost.

		month		
		€2908.5 (2981.8) (moderately severe/severe) per month		
		€568.1 (1,009.5) (mild, patient healthcare and social care costs) per month		
		€777.4 (1,281.3) (moderate, patient healthcare and social care costs) per month		
		€1,076.9 (1,775.6) (moderately severe/ severe, patient healthcare and social care costs) per month		

	[24]	£1207.58 per week	1995; 2000	This pilot study used data from staff members of the Dementia Day Hospital.
		£147 (NHS) per week		
		£117.88 (DSS[36] Benefits) per week		
		£124.09 (DSS care) per week		
		£241.97 (DSS Total) per week		
		£11.64 (Council tax exemption) per week		
		£0.21 patient		
		£1207.58 (carer at average DSS hourly rate)		

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[36] Department of social services

Appendix 5. Imperial College Business School Data Sources

Secondary outpatient	[28]	£284 for a first secondary outpatient attendance;	2008; 2010	The unit cost for the cost estimation was reported from the NHS Reference Cost Schedule 2007/08, but adjusted for inflation for the purpose of the paper.
Prescriptions	[41]	£500 per year per patients taking antipsychotic drugs	2009; 2011	The cost was estimated using a top down approach. The total expenditure was divided by the number of individuals living with dementia and using antipsychotic drugs.

4.6 Diabetes

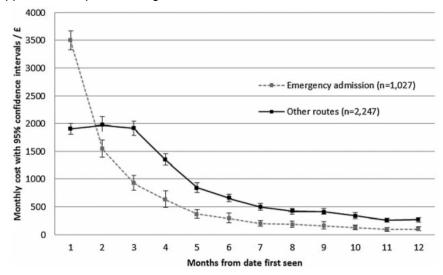| Cost	Refer ence	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Inflation adjusted cost – 2016 (based on Bank of England)[37]	Description
Social Care Type I	[2]	£383.23	2010; 2012	£450.93	Hex et al. used a top down approach to estimate the costs for diabetes patients. Among other objectives the paper was written to identify direct costs to the NHS and indirect costs of diabetes to the UK. Prevalence data were used from the Association of Public Health Observatories (APHO) Diabetes Prevalence Model (2010). Treatment costs have been computed based on data from Hospital Episode Statistics (HES) data. Indirect cost estimates were based on literature which accounted for social and productivity costs (e.g. diabetes related sickness absence from work). Costs were recorded as total expenditure for the whole population. The estimate is therefore based on a prevalence estimate in order to compute the cost per capita.
Social Care Type II	[2]	£1,457.77	2010; 2012	£1,715.13	
Social Care Type II	[4]	£3,241	2009; 2012	£3989.54	A study by the Nuffield Trust estimated the social care costs in the last year of life. This study uses NHS Secondary Users Services (SUS) data, GP register information and information on local authority funded social care services. The data of 73,243 people across 7 sites was used. The estimate is significantly higher (£3,241). According to this research, social care costs increased by 25% within the final 12 months of a patient's life on average [4]. The social care cost estimate includes costs on home care, residential care, nursing care, meals, day care, direct payments, equipment and adaptions, respite and other accommodation.

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[37] If necessary converted to GBP.

					The cost does not account for assessments.
	[22]	£1222	1998; 2003		A bottom-up approach was used. The study collected information of 653 patients and 253 carers above the age of 65. The study lacks in clear definitions and should therefore only be used as a rough guidance to identify true social care cost estimates.
Secondary outpatient	[33]	£206 per head (including diagnostic monitoring costs) £73 per head (excluding diagnostic monitoring costs)	2010;2011		The paper used the NHS reference costs 2008/09.
	[38]	£72 (cost per admission) £193 cost per patient	2000; 2004		This cost estimate is computed with reference to the last year before the end of life. Data from the Cardiff Diabetes Database was used. The costs were estimated using a statistical costing technique. As such, the study follows a bottom up approach.
Prescription s	[39]	£798 Total drug cost	Adjusted for 2010; 2012		Originally, cost estimates were reported by Currie et al., 2010. As such, the annual cost per patient was determined using a top-down approach. Prevalence data was not available in the paper by Currie et al, 2010. For this reason, the estimate by Kanavos et al, 2012 is to be sued.

4.7   Lung Cancer

Cost	Reference	Cost (annual if not otherwise stated)	Year of data record (when price was recorded) /study	Used for final model	Description
Social care (at advanced stage)	[3]	£1,077.00	2003 - 2008		This study is based on records of 8,072 people with a first diagnosis of cancer from 2 areas of England "for a year before diagnosis and up to 18 months after, excluding activity that occurred around the time of death". The study dates back to 2014. The figure reported is the average cost of social care in the final year of life. Social care costs included costs for residential care, nursing home, home care, residential respite care, direct payments made to users who can then 'buy' their own services, other accommodation, equipment and adaptions, day care, meals, telehealth/telecare and assessments.
Secondary outpatient	[30]	See screenshot £10 009	2008 – 2013		These costs estimates are associated with the diagnosis of lung cancer and clearly shows that costs decrease over time. It concludes that lung cancer diagnosed during an emergency leads to higher costs than for patients diagnosed at an Secondary outpatient clinic. A bottom up approach was employed for the purpose of this study.

Appendix 5. Imperial College Business School Data Sources

Mean monthly costs.

Notes: The table comes from reference [30].

4.8   Cardiovascular Diseases

R Luengo-Fernández, J Leal, A Gray, S Petersen, and M Rayner. Cost of cardiovascular diseases in the United Kingdom. Heart. 2006 Oct; 92(10): 1384–1389.

Table 3. Costs of cardiovascular disease in the UK in 2004

Type of resource used	Unit of measurement	Units of resources consumed	Average unit cost (£)
Healthcare cost			
Primary care	Doctor consultations at clinic	12542454	28.00
	Doctor consultations at home	2493546	65.00
	Nurse consultations at clinic	7733878	9.00
	Nurse consultations at home	90993	16.00
Accident and emergency	Attendances	581002	82.00
Hospital outpatient care	Attendances	1807652	111.88
Hospital inpatient care	Inpatient bed days	16097020	617.09
Hospital day case	Day cases	208721	717.76
Drugs	Prescriptions	226284133	10.72
	Dispensing	226284133	1.53
Cardiac rehabilitation	Rehabilitation programmes completed	413679	627.57
Community health/social services			
Healthcare cost adjusted for private care	Private funded part of total health expenditure		
Healthcare subtotal			
Non-healthcare cost			
Informal care	Caring by economically active carers (hours)	320688448	12.75
	Caring by economically inactive carers (hours)	201444020	4.85
Mortality	Working years lost (men)	195423	30 131
	Working years lost (women)	48975	21 730
Morbidity	Certified incapacity (days)	69346572	100.98
Morbidity (friction adjusted)			
Non-healthcare subtotal			
Friction adjusted			
Total economic burden			
Friction adjusted			

*Future earnings discounted at 3.5%.

4.9   Generic Costs

	National average	Lower quartile	Upper quartile
Elective/non elective Health Care Resource Group (HRG) data (average cost per episode)			
Elective inpatient stays	£3,191	£2,259	£3,775
Non-elective inpatient stays (long stays)	£2,461	£1,771	£2,865
Non-elective inpatient stays (short stays)	£586	£386	£688
Day cases HRG data			
Weighted average of all stays	£680	£460	£837
Outpatient procedures			
Weighted average of all outpatient procedures	£139	£101	£163
PALLIATIVE CARE			
Specialist Inpatient palliative care (adults only)	£405	£265	£476
Hospital specialist palliative care support (inpatient adults)	£114	£63	£121
Outpatient medical specialist palliative care attendance (adults 19 years and over)	£65	Not available	Not available
Outpatient non-medical specialist palliative care attendance (19 years and over)	£157	Not available	Not available
A&E SERVICES (Weighted average of attendances) [a]			
Accident and emergency treatments leading to admitted (not admitted)	£146 (£112)	£114 (£93)	£171 (£130)
Minor injury services leading to admitted (not admitted)	£66 (£63)	£51 (£47)	£77 (£71)
Walk in services leading to admitted (not admitted)	£32 (£41)	£28 (£31)	£34 (£46)
Non 24 hour A&E/Casualty Dept	£93(£91)	£89(£47)	£101(£119)
PARAMEDIC SERVICES			
Emergency transfers	£263	£248	£277
Average of all paramedic services (categories A, B & C)	£230	£209	£250

Notes: The costs in the following table have been uprated to 2010/11 levels using the HCHS Pay & Prices inflator. http://www.content.digital.nhs.uk/catalogue/PUB22240/pss-exp-eng-15-16-fin-rep.pdf

Note on ambulance services

1. Emergency ambulance journey: £246; http://www.pssru.ac.uk/pdf/uc/uc2010/uc2010.pdf
2. Ambulance transport from hospital: £40 per client; http://www.pssru.ac.uk/pdf/uc/uc2010/uc2010.pdf

Generally, ambulance costs per condition are not documented frequently. The NHS estimates that the national average of all paramedic services (categories A, B & C) is £230 with a lower quartile of £209 and an upper quartile of £250.

References for unit costs

Reference ID	Initial Report	Page	Link
[1]	The economic burden of stroke in the United Kingdom	18	Youman P, Wilson K, Harraf F, Kalra L. (2003) The economic burden of stroke in the United Kingdom. Pharmacoeconomics 21: 43–50. https://link.springer.com/article/10.2165%2F00019053-200321001-00005
[2]	Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs		Hex, N., Bartlett, C., Wright, D., Taylor, M. and Varley, D. (2012). Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. Diabetic Medicine, 29(7), pp.855-862. http://onlinelibrary.wiley.com/doi/10.1111/j.1464-5491.2012.03698.x/full
[4]	Understanding patterns of health and social care at the end of life	p.46, Table 5.2	Georghiou, T., Davies, S., Davies, A. and Bardsley, M. (2012). Understanding patterns of health and social care at the end of life. London: Nuffield Trust, p.46. https://www.nuffieldtrust.org.uk/files/2017-01/understanding-patterns-health-social-care-end-of-life-full-web-final.pdf
[5]	Dementia UK Update	p.18, Table D	Alzheimer's Society (2014). Dementia UK: update. London: Alzheimer's Society, p.18. https://www.alzheimers.org.uk/download/downloads/id/2323/dementia_uk_update.pdf
[6]	Cardiovascular Disease Statistics	p.88, Table 4.1	Townsend N, Williams J, Bhatnagar P, Wickramasinghe K, Rayner M (2014). Cardiovascular disease statistics, 2014. British Heart Foundation: London. https://www.bhf.org.uk/~/media/files/research/heart-statistics/bhf_cvd-statistics-2014_web.pdf

[8]	Excel Spread sheet: Programme Budgeting PCT benchmarking tool	sheet: Aggregate Spend	https://www.networks.nhs.uk/nhs-networks/health-investment-network/news/2012-13-programme-budgeting-data-is-now-available
[15]	The epidemiology, healthcare and societal burden and costs of asthma in the UK and its member nations: analyses of standalone and linked national databases	Table 5	Mukherjee, M., Stoddart, A., Gupta, R., Nwaru, B., Farr, A., Heaven, M., Fitzsimmons, D., Bandyopadhyay, A., Aftab, C., Simpson, C., Lyons, R., Fischbacher, C., Dibben, C., Shields, M., Phillips, C., Strachan, D., Davies, G., McKinstry, B. and Sheikh, A. (2016). The epidemiology, healthcare and societal burden and costs of asthma in the UK and its member nations: analyses of standalone and linked national databases. BMC Medicine, 14(1). https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-016-0657-8
[16]	The economic burden of asthma: direct and indirect costs in Switzerland		Szucs, T., Anderhub, H. and Rutishauser, M. (1999). The economic burden of asthma: direct and indirect costs in Switzerland. European Respiratory Journal, 13(2), pp.281-286. http://onlinelibrary.wiley.com/doi/10.1034/j.1399-3003.1999.13b10.x/full
[17]	Continuing to confront COPD International Patient Survey: Economic Impact of COPD in 12 Countries	Figure 3	Foo, J., Landis, S., Maskell, J., Oh, Y., van der Molen, T., Han, M., Mannino, D., Ichinose, M. and Punekar, Y. (2016). Continuing to Confront COPD International Patient Survey: Economic Impact of COPD in 12 Countries. PLOS ONE, 11(4), p.e0152618. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0152618
[18]	Health economics of COPD	Table 1	Halpin, D. and Tashkin, D. (2009). Defining Disease Modification in Chronic Obstructive Pulmonary Disease. COPD: Journal of Chronic Obstructive Pulmonary Disease, 6(3), pp.211-225. http://www.atsjournals.org/doi/pdf/10.1513/pats.200507-072SF
[19]	The burden of COPD in the U.K.: results from the Confronting COPD survey		Britton, M. (2003). The burden of COPD in the U.K.: results from the confronting COPD survey. Respiratory Medicine, 97, pp.S71-S79. http://ac.els-cdn.com/S0954611103800276/1-s2.0-S0954611103800276-main.pdf?_tid=1ac119c4-4dc4-11e7-8c0d-00000aab0f27&acdnat=1497089211_04ee44c1910da04bfbdf247ba8df7

			bb0
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[25]	Cost of cardiovascular diseases in the United Kingdom		Luengo-Fernandez, R., Leal, J., Gray, A. and Rayner, M. (2006). Cost of cardiovascular diseases in the United Kingdom.

			http://heart.bmj.com/content/92/10/1384.long
[26]	UK cost-consequence analysis of aripiprazole in schizophrenia: diabetes and coronary heart disease risk projections (STAR study)		Barnett, A.H., Millar, H.L., Loze, JY. et al. Eur Arch Psychiatry Clin Neurosci (2009) 259: 239. doi:10.1007/s00406-008-0863-2 https://link.springer.com/article/10.1007%2Fs00406-008-0863-2
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