Estimation of the direct health and indirect societal costs of diabetes in the UK using a cost of illness model

Received: 8 March 2024 | Accepted: 22 March 2024

DOI: 10.1111/dme.15326

DIABETIC Medicine

RESEARCH ARTICLE

Estimation of the direct health and indirect societal costs of diabetes in the UK using a cost of illness model

Nick Hex[1] | **Rachael MacDonald**[1] | **Jessica Pocock**[1] | **Barbara Uzdzinska**[1] | **Matthew Taylor**[1] | **Marc Atkin**[2] | **Sarah H. Wild**[3] | **Hannah Beba**[4] | **Ross Jones**[5]

[1]York Health Economics Consortium, Enterprise House, Innovation Way, University of York, York, UK

[2]Royal United Hospital Bath NHS Trust, Bath, UK

[3]Usher Institute, University of Edinburgh, Edinburgh, UK

[4]West Yorkshire Health and Care Partnership, Wakefield, UK

[5]Diabetes UK, London, UK

Correspondence
Nick Hex, York Health Economics Consortium, Enterprise House, Innovation Way, University of York, Heslington, York, YO10 5NQ, UK.
Email: nick.hex@york.ac.uk

Funding information
Diabetes UK

Abstract

Aims: The direct cost of diabetes to the UK health system was estimated at around £10 billion in 2012. This analysis updates that estimate using more recent and accurate data sources.

Methods: A pragmatic review of relevant data sources for UK nations was conducted, including population-level data sets and published literature, to generate estimates of costs separately for Type 1, Type 2 and gestational diabetes. A comprehensive cost framework, developed in collaboration with experts, was used to create a population-based cost of illness model.

The key driver of the analysis was prevalence of diabetes and its complications. Estimates were made of the excess costs of diagnosis, treatment and diabetes-related complications compared with the general UK population. Estimates of the indirect costs of diabetes focused on productivity losses due to absenteeism and premature mortality.

Results: The direct costs of diabetes in 2021/22 for the UK were estimated at £10.7 billion, of which just over 40% related to diagnosis and treatment, with the rest relating to the excess costs of complications. Indirect costs were estimated at £3.3 billion.

Conclusions: Diabetes remains a considerable cost burden in the UK, and the majority of those costs are still spent on potentially preventable complications. Although rates of some complications are reducing, prevalence continues to increase and effective approaches to primary and secondary prevention continue to be needed. Improvements in data capture, data quality and reporting, and further research on the human and financial implications of increasing incidence of Type 2 diabetes in younger people are recommended.

KEYWORDS

cost of illness, costs and cost analysis, diabetes, diabetes complications, economics, health economics

1 | INTRODUCTION

The direct cost of diabetes in the UK was estimated as £9.8 billion per year in 2012.[1] Diabetes-related complications made up nearly 80% of that cost and subsequent analysis showed that improvements in glycaemic control at a population level had the potential to reduce the disease burden and associated cost.[2]

Much has changed in the diabetes landscape since 2012, including continued increases in prevalence of Type 1 and Type 2 diabetes and changes to care processes and pathways, including the introduction of new technologies. It is timely, therefore, to revisit this analysis to consider the possible impact that those factors have had on the cost burden of diabetes in the UK, to further reinforce the need for effective approaches to primary and secondary prevention of diabetes and its complications.

Novelty statement

What is already known?

- Diabetes is a substantial cost to health systems and society.

What has this study found?

- An updated cost of illness analysis has found that diabetes remains a substantial cost, accounting for more than 6% of the UK health budget.
- Diabetes-related complications continue to account for the largest proportion of diabetes costs.

What are the implications of the study?

- Health commissioners need to continue to invest in diabetes prevention, care and treatment to reduce future costs of complications.
- There should also be a focus on improving data capture and collection of diabetes activity and outcomes.

2 | METHODS

A review of good practice methods for cost of illness (COI) studies in the academic literature did not identify detailed guidelines for this type of analysis. Pragmatic approaches tend to be used, based on the availability of evidence. The consensus was that COI studies should adopt a broad perspective, a prevalence-based epidemiological approach and, where possible, they should be costed using a bottom-up approach, for example using individual rather than aggregate data. The human capital approach was found to be the most suitable method of valuing productivity cost estimates within COI studies.

This study has adopted a top-down approach to estimate the costs for Type 1, Type 2 and gestational diabetes from aggregated data sets, using secondary evidence sources. It was not possible to adopt a bottom-up analysis approach as it was not feasible to use patient-level data due to a lack of availability of robust data sets. Evidence sources to inform the study were identified through targeted literature searches in MEDLINE, from UK published data and clinical guidelines. Where data sources were not available, expert opinion was sought from clinicians with recognised expertise in diabetes. Detail on the specific analysis inputs is provided as Supplementary material S1.

A comprehensive cost framework was developed in consultation with a steering group of expert stakeholders, to establish the key factors contributing to the direct and indirect costs of diabetes and potential additional data sources. The framework included prevalence and incidence rates for diabetes, diagnosis, ongoing treatment and management of diabetes, prevalence and incidence rates of complications, and premature mortality associated with diabetes.

The cost framework was used to develop a population-based COI model in Microsoft Excel, from the perspective of the UK National Health Service (NHS), personal social services (PSS) and society. Formal social care costs are included within the model but we are unable to separate them from total costs. For example, some complication costs were estimated from economic modelling in the National Institute for Health and Care Excellence (NICE) guidelines and are inclusive of social care costs. Informal care is not costed directly because the estimate of societal costs includes the non-working age population and will account for carers' time.

The key driver within the model is prevalence of diabetes and associated complications. The healthcare resource use of individuals with Type 1, Type 2 and gestational diabetes were compared to that of the general population, to estimate the excess costs of diabetes to the health system in the UK.

All costs are based on the 2021/22 financial year. Costs for future years were calculated based on estimated growth in diabetes prevalence over time, disregarding the effects of cost inflation over this period.

2.1 | Prevalence of diabetes

The COI model accounts for diabetes prevalence within each UK nation. Data on the prevalence of diabetes for England and Wales were sourced from the National

Diabetes Audit (NDA) 2021/22 data release.[3] The NDA records data on all people of all ages with a diagnosis of diabetes in England and Wales. Prevalence data for Scotland were sourced from the Scottish Diabetes Survey 2022.[4] Both data sets also include data on people diagnosed within the previous 12 months that allow estimation of diabetes incidence. For Northern Ireland, prevalence data for people aged 17+ were sourced from Department of Health statistics and it was assumed that the proportion of the under 17 population in Northern Ireland with diabetes would be the same as in Scotland.[5]

The numbers of people with Type 1 and Type 2 diabetes in each UK nation and UK population estimates from the Office of National Statistics (ONS) were used to estimate the whole proportion of the UK population with diabetes.[6] The Type 2 diabetes population includes people with other, rare, types of diabetes. It was assumed that these people will incur the same annual costs as people with Type 2 diabetes. Data from Scotland and expert clinical opinion were used to inform prevalence of gestational diabetes. Management and complication costs related to pregnancy only were applied to the gestational diabetes population.

2.2 | Estimation of diagnosis and treatment costs

Ongoing treatment and management costs were estimated separately for Type 1, Type 2 and gestational diabetes. Estimated treatment and management costs included diagnostic testing, appointments (primary care consultations, foot clinics, retinal screening, dietary advice, secondary care consultations and psychological input for children), glucose control and antidiabetic drugs (consumables, monitoring devices and insulin pumps), and blood pressure, lipid levels and antithrombotic therapies. Additional appointments required during pregnancy were also accounted for.

Calculations were based on cost evidence and treatment recommendations presented in NICE clinical guidelines NG17[7] and NG28.[8] Data on primary and secondary care consultation activity for the general population were sourced from NHS Digital statistics.[9,10] These values were subtracted from those for the population with diabetes in order to estimate excess resource use. It was assumed that the general population would not be prescribed insulin or other glucose lowering drugs. Appointment costs were sourced from the Unit Costs of Health and Social Care[11] and drugs costs from the electronic market information tool (eMIT) national database.[12] Insulin and other glucose lowering drug costs were sourced from the Prescribing for Diabetes data set.[13]

2.3 | Estimation of complication costs

Complications were categorised into acute events, chronic macrovascular disease, microvascular disease and complications related to pregnancy. Prevalence inputs for complications were sourced from a combination of the NDA mortality and complications dashboard,[14] Scottish Diabetes Survey[4] and published studies. The sources used for each complication are presented in Supplementary material S1.

Where data were not available, assumptions were made and their validity checked with the study steering group. Inputs from published studies were extrapolated so that they were applicable to the entire population. Where an input value was identified for one nation and not the others, it was assumed that this value would be the same for other nations. Additionally, where an input value was identified for the Type 1 population but not the Type 2 population or vice versa, it was assumed that they would be the same for both types. Input values for each UK nation were used to estimate a weighted average for the UK for each complication.

Data from the NDA mortality and complications dashboard[14] were used to source the incidence of myocardial infarction, stroke and amputations. Data from the Scottish Diabetes Survey[4] were used to establish the prevalence of ever having a stroke, myocardial infarction or amputation among people with diabetes. Differential costs were applied in the year the event occurred and subsequent years for these complications only, as the costs were found to differ substantially. The incidence of diabetic foot ulcers was sourced from the Scottish Diabetes Survey.[4] Prevalence only was considered for all other ongoing complications and conditions, with the assumption that the same cost could be applied each year. Input costs for angina and hypertension related only to cases where an emergency department attendance or a hospital admission occurred, to avoid potential double counting of treatments for blood pressure, lipid levels and antithrombotic therapies already accounted for within ongoing management calculations.

For gestational diabetes, only complications related to pregnancy were included, to avoid potential double counting with the Type 2 diabetes population which would include any post-pregnancy complications. Input values for pregnancy-related complications specific to the gestational diabetes population could not be identified, so it was assumed that these values were equal to those for the Type 2 diabetes population.

Complication costs were primarily sourced from NHS Cost Collection data[15] and economic modelling reports for NICE guidelines NG17[7] and NG28.[8]

2.4 | Estimation of indirect costs

There is little published evidence relating to the non-healthcare-related costs of diabetes. No robust evidence was identified in relation to the effects of diabetes on presenteeism, informal care giving or unemployment since 2012, so this represents a narrower estimate of the potential indirect costs of diabetes.

The analysis only accounted for productivity losses due to absenteeism and early mortality. The economic value of informal care giving is incorporated into these calculations. The human capital approach was used to value productivity losses for people of all ages, not just those of working age.

Absenteeism was estimated as the excess average number of sickness absence days for the population with diabetes compared with the general population. The study used to inform this input was conducted in Israel which may not apply to a UK setting.[16] No studies specific to absenteeism associated with diabetes in the UK could be identified.

Premature mortality was estimated using the potential years of life lost (PYLL) method. The reference age used was 81 years which is the current average life expectancy in the UK. ONS data were used to identify cases where diabetes was listed as the underlying cause of death in England and Wales. No breakdown by diabetes type was available. Granular age breakdowns required to estimate PYLL were not available for England and Wales, although they were available for Scotland. As a result, total deaths in England and Wales were profiled to reflect the Scottish population, to estimate the proportion of the population by age that would be expected to die each year. The same proportions were applied to all UK nations.

The UK average wage was used as a proxy value to monetise the potential lost productivity due to morbidity-related absenteeism and early mortality. Using the human capital approach, this value was applied to the entire population including people of working and non-working age. While it is expected that the value of lost productivity varies by age and other individual characteristics, it was not possible to source more specific values so the same cost was applied to the entire population. The non-working age population are included within absenteeism and PYLL calculations to account for lost education, volunteering, care giving and any other productive activities that may be affected by morbidity and early mortality.

2.5 | Sensitivity analysis

There is a considerable degree of uncertainty in the COI model inputs due to gaps in evidence and difficulties in reconciling evidence from different sources. For example, while official recorded rates of mortality associated with diabetes were used, there is evidence that the number of deaths for which diabetes is an underlying cause is substantially lower than the actual number.[17] Deterministic sensitivity analysis was conducted to assess the effect of varying the total diabetes population to account for undiagnosed cases, doubling the rate of mortality associated with diabetes and varying the number of primary care appointments. These were parameters considered to be the most conservative in the analysis by the study steering group.

3 | RESULTS

The proportion of the UK population with a diagnosis of diabetes in 2021/22 is estimated at approximately 0.5% for Type 1 diabetes and 5.8% for Type 2 diabetes. Approximately 12,000 and 217,000 of these cases, respectively, were diagnosed within the previous year. The proportion of pregnancies in which the mother has a diagnosis of gestational diabetes is estimated as 9.8%.

The excess direct healthcare cost estimates for Type 1 and Type 2 diabetes are shown in Table 1. The total cost of direct care is estimated at £10,652,213,000. The total indirect costs are estimated at £3,284,854,000. Within the direct costs of diabetes, diagnosis costs are estimated at £76,405,000, ongoing management costs are estimated at £4,405,725,000 and the cost of diabetes-related complications is estimated at £6,170,083,000.

Table 2 shows the estimated direct healthcare pregnancy-related management and complication costs associated with gestational diabetes of £147,454,000.

Table 3 outlines the estimated indirect costs of diabetes. It was not possible to separate these costs by diabetes type.

Table 4 outlines the total number of potential years of life lost and number of sickness days for the population.

Cost projections over the next 15 years are presented in Table 5. Projections are driven by increases in the prevalence of diabetes only and assume that no changes are made to the way diabetes is treated over that time.

Deterministic sensitivity analysis was used to test the sensitivity of the results to changes in the total prevalence of diabetes, the rate of diabetes-related mortality and primary care appointment numbers. The results of this analysis are presented in Table 6.

4 | DISCUSSION

The cost of diabetes in the UK for 2021/22 was estimated at approximately £14 billion. Direct costs to the health system are estimated at £10.7 billion, of which just over 40%

TABLE 1 Estimated direct healthcare costs of Type 1 and Type 2 diabetes.

Input	Type 1	Type 2
Diagnosis	£6,205,000	£70,200,000
Ongoing management		
Appointments	£64,751,000	£797,384,000
Glucose control	£743,151,000	£1,752,155,000
Blood pressure, lipid levels and antithrombotic therapy	£2,397,000	£28,457,000
Appointments during pregnancy	£397,886,000	£605,989,000
Total	£1,208,185,000	£3,183,985,000
Acute event complications		
Severe hypoglycaemia	£44,795,000	£11,498,000
Diabetic ketoacidosis	£29,223,000	£16,767,000
Hyperosmolar hyperglycaemic state	–	£306,724,000
Total	£74,018,000	£334,988,000
Microvascular complications		
Renal replacement therapy	£150,520,000	£690,425,000
Diabetic retinopathy	£21,825,000	£78,293,000
Diabetic macular oedema	£5,699,000	£18,768,000
Blindness	£1,396,000	£16,576,000
Amputation	£37,612,000	£429,914,000
Peripheral neuropathy	£1,435,000	£25,394,000
Foot Ulceration	£17,838,000	£129,730,000
Erectile dysfunction	249,000	£28,364,000
Total	£236,574,000	£1,417,463,000
Macrovascular complications		
Angina	£5,961,000	£126,356,000
Hypertension	£257,000	£3,432,000
Myocardial infarction	£11,095,000	£353,536,000
Stroke	£9,930,000	£184,916,000
Cardiomyopathy	£6,810,000	£1,437,191,000
Coronary heart disease	£48,700,000	£1,440,475,000
Heart failure	£12,318,000	£313,831,000
Total	£95,072,000	£3,859,737,000
Pregnancy-related complications		
Labour induced	£0	£0
Elective caesarean	£3,565,000	£3,866,000
Emergency caesarean	£4,676,000	£2,922,000
Pre-eclampsia	£485,000	£382,000
Congenital malformations	£161,000	£140,000
Preterm birth	£1,383,000	£682,000
Still birth	£39,000	£32,200
Total	£10,308,000	£8,024,000

(£4.4 billion) relate to diagnosis and ongoing management diabetes, with around 60% relating to the complications of diabetes. This represented around 6.3% of the £169 billion budget for the Department of Health and Social Care in 2023/24.[18] This compares with a direct cost of diabetes of around 7% of the budget for health care in the USA or around 10% in Germany.[19,20]

TABLE 2 Estimated direct healthcare costs of gestational diabetes.

Input	Gestational diabetes costs
Appointments	£13,555,000
Labour induced	£0
Elective caesarean	£64,518,000
Emergency caesarean	£48,752,000
Pre-eclampsia	£6,380,000
Congenital malformations	£2,333,000
Preterm birth	£11,379,000
Still birth	£537,000
Total	£147,454,000

TABLE 3 Estimated indirect costs of diabetes.

Input	Cost
Absenteeism	£1,699,218,000
Early mortality	£1,585,636,000
Total	£3,284,854,000

TABLE 4 Total potential years of life lost and sickness absence days.

Potential years of life lost	Sickness absence days
237,935	11,792,907

This study used a pragmatic but robust method, based on the most relevant and up to date data available. The estimates of the cost of diabetes in the UK are based on more accurate data than used in the 2012 estimates and for this reason direct comparisons cannot be drawn.[1] For example, in 2012 complication rates were based on analysis of Hospital Episode Statistics data, while the current analysis uses evidence from both primary and secondary care from the NDA. In 2012, the prevalence of Type 1 diabetes was based on a modelled data source, while the rate used in the current analysis is based on audit data from England and population-level data for Scotland.

Ongoing management costs are substantial but this reflects both the increased prevalence of people with diabetes and innovation and new technologies that the NHS has adopted. Complication costs are also substantial but a reduction in complication rates has been observed in recent years alongside improvements in routine diabetes care over time, at least prior to the pandemic.[21] While there may be other contributory factors such as secular trends in

TABLE 5 Estimated costs of diabetes over 15 years.

Year	Diagnosis costs	Management costs	Complication costs	Total direct costs	Total indirect costs
Year 1	£76,405,000	£4,405,725,000	£6,170,083,000	£10,652,213,000	£3,284,854,000
Year 2	£80,076,000	£4,626,193,000	£6,463,377,000	£11,169,646,000	£3,442,577,000
Year 3	£83,756,000	£4,847,224,000	£6,757,319,000	£11,688,299,000	£3,600,659,000
Year 4	£87,437,000	£5,068,364,000	£7,051,286,000	£12,207,087,000	£3,758,768,000
Year 5	£91,111,000	£5,289,236,000	£7,344,771,000	£12,725,119,000	£3,916,631,000
Year 6	£94,776,000	£5,509,555,000	£7,637,391,000	£13,241,721,000	£4,074,042,000
Year 7	£98,449,000	£5,730,445,000	£7,930,718,000	£13,759,612,000	£4,231,839,000
Year 8	£102,130,000	£5,951,828,000	£8,224,647,000	£14,278,605,000	£4,389,966,000
Year 9	£105,817,000	£6,173,639,000	£8,524,003,000	£14,803,460,000	£4,548,378,000
Year 10	£109,511,000	£6,395,844,000	£8,814,017,000	£15,319,373,000	£4,707,050,000
Year 11	£113,211,000	£6,618,437,000	£9,109,412,000	£15,841,060,000	£4,865,980,000
Year 12	£116,916,000	£6,841,394,000	£9,405,249,000	£16,363,559,000	£5,025,153,000
Year 13	£120,627,000	£7,064,717,000	£9,701,535,000	£16,886,879,000	£5,184,572,000
Year 14	£124,345,000	£7,288,468,000	£9,998,357,000	£17,411,170,000	£5,344,282,000
Year 15	£128,073,000	£7,512,840,000	£10,295,984,000	£17,936,898,000	£5,504,428,000

TABLE 6 Deterministic sensitivity analysis.

Input	Variation	Base case total cost in year 1	Upper value total cost in year 1
Prevalence	+20%	£13,937,067,000	£16,716,335,000
Primary care appointments (GP, nurse and other practitioners)	+25%	£13,937,067,000	£14,174,081,000
Early mortality	+100%	£13,937,067,000	£15,522,704,000

smoking, this pattern suggests that investing in improved routine care and secondary prevention may contribute to reducing the very large costs of diabetes complications.

The high ongoing care costs may be attributed to improved management of diabetes and increased spending on treatments and technologies that support effective management. But they are also accounted for by increases in prevalence of diabetes due to a combination of factors including population ageing, possible increases in screening and detection of undiagnosed diabetes and improved survival of people with diabetes. In particular, there have been substantial increases in the number of young people, under 40 years of age, with Type 2 diabetes in recent years.[22]

While trends in complication rates have been reducing for the older diabetes population, younger onset of Type 2 diabetes is associated with excess risk of microvascular complications, adverse cardiovascular outcomes and earlier death.[22] This suggests that while overall complication rates and costs have reduced, there is the potential for these to increase if approaches to primary and secondary prevention of Type 2 diabetes in young people with diabetes are not effective. This will also have an impact on indirect costs to society as a larger proportion of the working age population will have diabetes.

The primary limitation of this study is the limited availability of good quality data. Patient-level data were not available to the authors and so this study used aggregate data. Data were taken from many different sources, and assumptions were necessary in order to populate the COI model. Combining data from multiple sources and nations in this way creates uncertainty in the inputs; however, this approach made use of the best data available.

It is likely that the costs in primary care may have been underestimated due to the lack of accurate data on activity and outcomes in that setting (aside from care processes captured in the NDA and the Scottish Diabetes Survey). As diabetes care becomes more complex in primary and community care settings, due to increasing management of early complications and a rise in people with comorbidities, it will be important that local health systems, working within a health population model, have the tools and expertise to capture, share and understand the data.

5 | CONCLUSIONS

Complication costs represent the largest proportion of diabetes-related costs. An emphasis on treating to target early

in the disease can help to reduce those costs through primary and secondary prevention. Health commissioners should continue to invest in diabetes prevention, care and treatment to reduce future costs of complications with population-level interventions in addition to individual approaches.

Health systems should ensure improved data capture and reporting nationally and locally for use in quality improvement as well as addressing gaps in data required for research. Data should be disaggregated by sex, ethnicity and deprivation to allow for greater understanding of the drivers of resource use.

Local systems should use the COI model to understand how and what they are spending on diabetes care and complications and how to share investment between primary, secondary and tertiary prevention in order to improve population health and reduce future costs.

Further research is needed on the optimal strategies to deploy in managing Type 2 diabetes in adolescents and young adults.

There is a need for studies that examine the cost-effectiveness of new drugs and technologies based on real-world evidence.

FUNDING INFORMATION

The study was funded by Diabetes UK.

CONFLICT OF INTEREST STATEMENT

Ross Jones is an employee of Diabetes UK.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

ORCID

Nick Hex https://orcid.org/0000-0002-6181-9429
Sarah H. Wild https://orcid.org/0000-0001-7824-2569
Hannah Beba https://orcid.org/0000-0002-0674-3724

REFERENCES

1. Hex N, Bartlett C, Wright D, Taylor M, Varley D. 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. *Diabet Med*. 2012;29(7):855-862.
2. Baxter M, Hudson R, Mahon J, et al. Estimating the impact of better management of glycaemic control in adults with type 1 and type 2 diabetes on the number of clinical complications and the associated financial benefit. *Diabet Med*. 2016;33(11):1575-1581.
3. NHS England. National Diabetes Audit 2021–22 Data Release. 2021. https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-audit/nda-core-21-22/nda-core-21-22-data
4. NHS Scotland. Scottish Diabetes Survey 2022. 2022. https://www.diabetesinscotland.org.uk/wp-content/uploads/2023/10/Scottish-Diabetes-Survey-2022.pdf#new_tab
5. Department of Health. Raw Disease Prevalence in Northern Ireland – 2022/23. https://www.health-ni.gov.uk/news/raw-disease-prevalence-northern-ireland-202223
6. Office for National Statistics. Population Estimates for the UK, England, Wales, Scotland, and Northern Ireland. 2022. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland
7. National Clinical Guideline Centre, National Institute for Health and Care Excellence (NICE). Clinical Guideline NG17. Type 1 diabetes in adults: diagnosis and management. 2022. https://www.nice.org.uk/guidance/ng17
8. National Clinical Guideline Centre, National Institute for Health and Care Excellence (NICE). Clinical Guideline NG28. Type 2 diabetes in adults: management. 2022. https://www.nice.org.uk/guidance/ng28
9. NHS England. Appointments in General Practice. 2023. https://digital.nhs.uk/data-and-information/publications/statistical/appointments-in-general-practice
10. NHS England. Hospital Outpatient Activity. 2022. https://digital.nhs.uk/data-and-information/publications/statistical/hospital-outpatient-activity/2021-22
11. Jones KC, Weatherly H, Birch S, et al. Unit Costs of Health and Social Care 2022 Manual. https://kar.kent.ac.uk/100519/
12. Department of Health and Social Care. Drugs and pharmaceutical electronic market information tool (eMIT). 2022. https://www.gov.uk/government/publications/drugs-and-pharmaceutical-electronic-market-information-emit
13. NHS Business Services Authority. Prescribing for Diabetes 2021. https://www.nhsbsa.nhs.uk/statistical-collections/prescribing-diabetes-england/prescribing-diabetes-england-201516-202122
14. NHS England National Diabetes Audit Complications and Mortality Dashboard. England 2021. https://digital.nhs.uk/data-and-information/clinical-audits-and-registries/national-diabetes-audit/dashboards
15. NHS England. National Schedule of NHS costs 2021/22. 2022. https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection/#:~:text=The%20National%20Cost%20Collection%20publication,related%20to%20their%20healthcare%20activity
16. Zack O, Golob I, Chodick G, Perluk I, Raanan R, Moshe S. The correlation between clinical and demographic parameters and sickness absence in diabetic employees. *Dent Health*. 2021;9(10):1309. doi:10.3390/healthcare9101309
17. Pearson-Stuttard J, Bennett J, Cheng YJ, et al. Trends in predominant causes of death in individuals with and without diabetes in England from 2001 to 2018: an epidemiological analysis of linked primary care records. *Lancet Diabetes Endocrinol*. 2021;9(3):165-173. doi:10.1016/S2213-8587(20)30431-9
18. The King's Fund. Key facts and figures about the NHS. 2023. Available from: https://www.kingsfund.org.uk/insight-and-analysis/data-and-charts/key-facts-figures-nhs
19. Parker ED, Lin J, Mahoney T, et al. Economic costs of diabetes in the U.S. in 2022. *Diabetes Care*. 2024;47(1):26-43. doi:10.2337/dci23-0085
20. Jacobs E, Hoyer A, Brinks R, Icks A, Kuß O, Rathmann W. Healthcare costs of type 2 diabetes in Germany. *Diabet Med*. 2017;34(6):855-861. doi:10.1111/dme.13336

21. Pearson-Stuttard J, Cheng YJ, Bennett J, et al. Trends in leading causes of hospitalisation of adults with diabetes in England from 2003 to 2018: an epidemiological analysis of linked primary care records. *Lancet Diabetes Endocrinol*. 2022;10(1):46-57. doi:10.1016/S2213-8587(21)00288-6
22. Misra S, Ke C, Srinivasan S, et al. Current insights and emerging trends in early-onset type 2 diabetes. *Lancet Diabetes Endocrinol*. 2023;11(10):768-782. doi:10.1016/S2213-8587(23)00225-5

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Hex N, MacDonald R, Pocock J, et al. Estimation of the direct health and indirect societal costs of diabetes in the UK using a cost of illness model. *Diabet Med*. 2024;00:e15326. doi:10.1111/dme.15326