York Health Economics Consortium

THE BRAIN TUMOUR CHARITY

The Burden of Illness of Brain Tumours in the UK Report

Final Report

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Executive Summary

1. BACKGROUND

Each year, around 13,000 people are diagnosed with a brain tumour, and 5,300 people lose their lives as a consequence of this disease. Brain tumours are the biggest cancer killer of children and adults under 40. They have a substantial impact on society, through their impact on health and mortality, healthcare treatment costs, unemployment and welfare benefits and educational attainment. However, little previous research has used this evidence to estimate the economic burden that brain tumours have on society in the UK.

2. METHODS

The burden of illness from brain tumours diagnosed in 2025, and the impact that this will have over the rest of those people's lifetime was calculated. Estimating the burden of illness comprised two broad categories of impact: (i) the financial costs and (ii) the health impacts of developing a brain tumour. The financial costs captured in this analysis included direct healthcare costs from treating the disease, income lost due to the disease (whilst alive and due to premature death), excess welfare system costs and additional care requirements, beyond treatment. A monetary value to the health impact was assigned to quantify the burden of illness as the sum of financial costs and health impacts as a monetary value.

The analysis captured different impacts by brain tumour type (malignant or non-malignant) and by age group (adult or child). Malignant tumours are cancerous, tend to grow rapidly, and can invade surrounding tissues and spread to other parts of the body. Non-malignant tumours tend to grow more slowly, and are less likely to spread. The primary analysis estimated the overall burden of illness for all brain tumours in the UK. However, this result was also broken down to estimate the burden of illness of each tumour type, age groups, for different countries within the UK, and for different levels of deprivation.

The impact on education as an outcome was also included in the analysis. The expected educational attainment of the average UK population was calculated and compared with the educational attainment expected for people with malignant and non-malignant brain tumours.

Several key assumptions were made. Firstly, the model does not distinguish malignant and non-malignant tumours by more specific tumour types, due to the limited availability of evidence. Secondly, where sourced input data could not be split by malignant or non-malignant tumours or by age group, it was assumed that evidence was generalisable to both tumour types. Finally, some factors are not quantified in this analysis, such as disease progression, disease recurrence, palliative care costs and outpatient costs for non-malignant tumours. This conservative approach means the results are likely to be an underestimate of the societal burden associated with brain tumours

A scenario was included in the model to explore the impact of earlier diagnoses through inpatient stays and mortality.

3. RESULTS

The burden of illness of brain tumours diagnosed in the UK in 2025 is estimated to be approximately £18.7 billion over the rest of those people's lifetime. Malignant tumours accounted for 86% of the total burden of illness. When uncertainty of the results was tested, it was found that the range of estimates for the burden of illness was between £16.5 billion and £20 billion. Premature mortality was the largest contributor to the overall burden with this reflected in terms of health lost and future income lost. This is explained by the high mortality rate associated with brain tumours. Per tumour in the UK, the burden to society is over £1.4 million for a person's lifetime.

The distribution of the burden of illness for each country within the UK was primarily influenced by the population size of that country. England had a slightly lower burden of illness relative to its population size, whereas the opposite was observed for the other countries.

When comparing the burden of illness by specific deprivation groups, the results were stratified by the Index of Multiple Deprivation (IMD). IMD is a measure of relative deprivation, based on the wider determinants of health (the social, economic, and environmental factors where people are born, live, work, and which significantly impact their health and wellbeing). The most deprived groups (IMD quintiles 1 and 2) had a relatively similar burden of illness compared with the least deprived groups (IMD quintiles 4 and 5). However, this does not account for differences in health outcomes, such as earlier diagnosis or more effective treatment outcomes. This is because in the model, factors that affect more deprived groups were not considered, for example, reduced access to care or treatment. Instead, only differences in the proportions who develop the disease were considered, not the differences in outcomes afterwards.

The scenario exploring earlier diagnosis found that a two-week reduction in average time until diagnosis could reduce the burden of illness in the UK by £800 million. This scenario highlights the potential value of an earlier diagnosis on outcomes, and one of the levers to consider improving outcomes for people diagnosed with brain tumours.

Finally, compared with those without a brain tumour, children developing a brain tumour are more than twice as likely to have no educational qualifications, and are less likely to achieve a university education. This highlights one mechanism via which developing a brain tumour as a child may influence their long-term outcomes.

4. CONCLUSION

This research found that there is a substantial burden of illness of brain tumours in the UK, and this is largely driven by premature mortality and the associated loss in health and forgone income. There is potential to reduce the overall burden through policy levers that may enable earlier diagnosis of brain tumours.

Abbreviations

HRQoL	Health related quality of life
IMD	Index of Multiple Deprivation
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NISRA	Northern Ireland Statistics and Research Agency
ONS	Office for National Statistics
PSA	Probabilistic Sensitivity Analysis
PSSRU	Personal Social Services Research Unit
QALY	Quality-adjusted life year
WHO	World Health Organisation
YPLPLL	Years of Potential Labour Productive Life Lost

1 Introduction

1.1 Background

Brain tumours are the biggest cause of cancer-related death in children and adults under 40 years old [1]. Furthermore, around 13,000 people are diagnosed each year with a primary brain tumour, including 500 children and young people, with over 5,300 deaths per year [1]. In February 2018, the Government and Cancer Research UK announced that they would spend a total of £45 million, over a five-year period, on brain tumour research. In May 2018 the Government announced they would be investing £40 million in brain tumour research. However, of the £40 million commitment, by January 2023 just £15 million had been awarded, with £6 million of this not easily identifiable as relevant to brain tumours [2]. This lower investment is likely to contribute to relatively poorer outcomes, slower diagnosis, and limited access to innovative treatments to improve health outcomes for people with brain tumours.

The Brain Tumour Charity is developing a report on the cost of inaction for publication in 2025. As part of the report, an estimate for the burden of illness associated with brain tumours was required. This aims to capture the economic burden on individuals, carers, public services, and the wider economy. These outputs of the economic model will contribute to the report and help understand the impact that brain tumours have on society, and outline where policy solutions could be targeted to reduce the burden.

1.2 Objectives

A burden of illness model was developed to estimate the impacts of brain tumours on people with the condition, carers, public services and the wider economy in the UK. The calculated burden of illness captures both financial and health impacts related to brain tumours. The data from the model will contribute to a report on barriers to innovation and treatment for individuals with brain tumours.

2 Modelling Approach and Methods

2.1 Model Overview and Decision Problem

A pathway model was developed to calculate the burden of illness of brain tumours in the UK. The model was built using Microsoft Excel and was designed in a user-friendly format whereby the user can access a full range of input sheets. The model has been built to allow all major inputs to be easily changed by the model user, including, but not limited to, the incidence and cost inputs.

The key outcome of the pathway model was the burden of illness. This was the sum of the financial costs and health impacts. Health impacts were measured using QALYs which is a summary outcome measure, calculated by multiplying health utilities (a measure of health-related quality of life) by expected life years [3]. As per treasury Green Book recommendations, a monetary value of £70,000 was assigned for each QALY lost [4].

Discounting was not undertaken because the burden was measured and not present value. Present value is only used in decision making, rather than informative or planning research.

The burden of illness was calculated such that it reflected the lifetime impact on people who would be expected to be diagnosed with a brain tumour in 2025.

The decision problem for the model is displayed in Table 2.1.

Table 2.1: Decision Problem

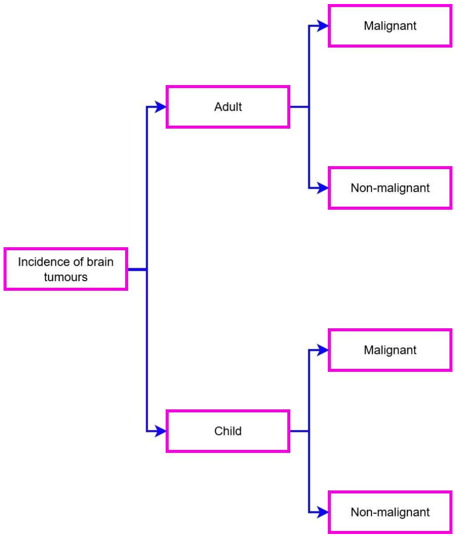
Model element	Description
Population	Individuals with a brain or CNS tumour. Subgroups included: ▪ Adults and children ▪ Malignant and non-malignant ▪ UK country ▪ Deprivation group
Model type	Burden of illness pathway model
Perspective	Societal with outcomes stratified by sectors
Outcomes	Burden of illness (this was the sum of the financial costs and monetary value of the QALYs lost). Outcomes were stratified by subgroup.

Abbreviations: CNS – central nervous system; QALY – quality-adjusted life year; UK – United Kingdom.

2.2 Model Structure

The burden of illness model was structured as a pathway model which is shown in Figure 2.1. It mapped out the key characteristics of the brain tumour population (by malignant or non-malignant brain tumour and by age [adult or child]). These distinctions were chosen based on their expected differences in outcomes and availability of data. For instance, the evidence was generally reported for patient groups which included a range of tumour grades and, therefore, their outcomes could not be broken down into specific grades. Based on the evidence available, differentiating between malignant and non-malignant types was considered the most specific breakdown possible.

Figure 2.1: Pathway model diagram



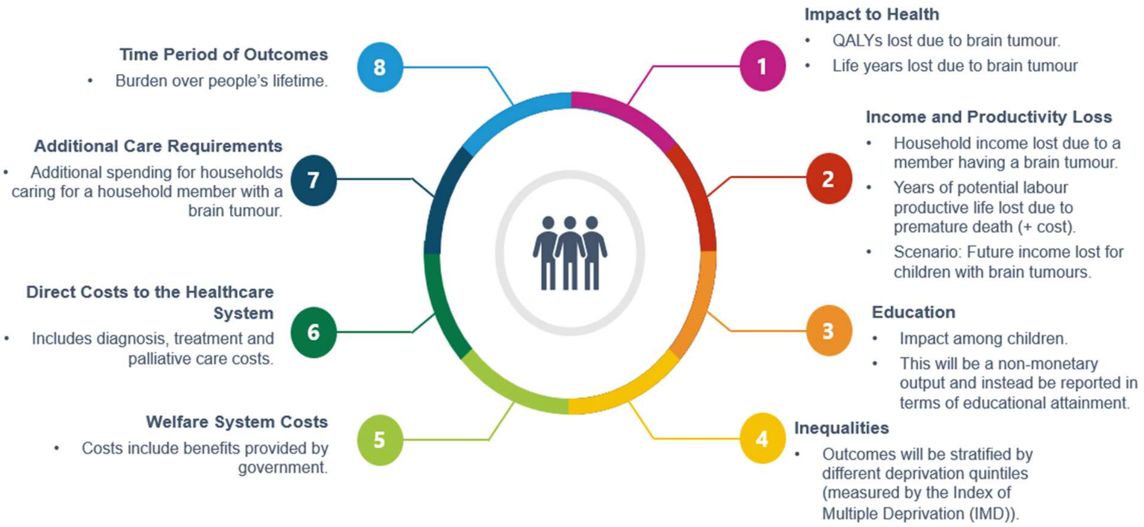
To calculate the total number of people at each node, incidence rates were applied for malignant and non-malignant tumours for both adult and child age groups. For the different subgroups (country and deprivation), subgroup-specific incidence rates were used to determine the distribution of tumours in each group. The total number of people at each end node was multiplied by each 'payoff' outcome. These outcomes were then summed to calculate the total expected financial costs, total expected QALYs lost and total expected burden of illness.

The specific treatment and outcome pathways post-diagnosis were not modelled. Instead, evidence that already exists from studies which have explored these outputs were collated. For example, QALYs for children with brain tumours have been sourced from a published Health Technology Assessment. Evidence for the per-person outcomes of interest, e.g., direct costs for a malignant brain tumour in adults, were sourced from other studies. These acted as a per-person 'pay off' in the pathway model to reflect the entirety of the outcome for that person.

2.3 Quantifying Outcomes

The key outcome of the economic model was the burden of illness. This was the sum of the financial costs and the monetary value of the QALYs lost. Individual outcomes are displayed in Figure 2.2.

Figure 2.2 Model outcomes



Financial costs included direct health care costs (diagnosis costs and treatment costs), household income lost whilst alive, income loss due to premature death, additional welfare system costs and additional care requirement costs. To calculate the monetary value of the health impact, the QALYs lost due to brain tumours were calculated, and multiplied by £70,000 as specified in the green book [4]. The overall burden of illness was then calculated as the sum of the financial costs and the monetary value of the QALYs lost. These outcomes were then stratified by tumour type (malignant and non-malignant), UK country, deprivation quintile and age group.

The impact of brain tumours on educational attainment was also estimated. The outputs here were the expected and estimated education levels for individuals who have or had a malignant or non-malignant brain tumour as a child. This is reported as the differences in those with no qualifications (i.e. no GCSEs) and those with bachelor's or above.

2.4 Uncertainty Exploration

Probabilistic sensitivity analysis (PSA) is a technique used in economic modelling that allows the modeller to quantify the level of confidence in the output of the analysis, in relation to uncertainty in the model inputs. In a PSA, a set of input parameter values is drawn by random sampling from each distribution, and the model is 'run' to generate outputs (cost and health outcome), which are stored and repeated many times.

To generate the input values for each iteration, distributions were fitted to uncertain parameters within the model. A simulation was then conducted whereby random values are drawn from the probability distribution of all key parameters simultaneously. Each simultaneous draw represents an iteration of the simulation, in which the model results are calculated based on the new point estimate of each parameter included in the probabilistic analysis. A burden of illness was then calculated and recorded for each iteration. The simulation used to calculate probabilistic results for this report was 5,000 iterations, after which convergence (stability of the results) was achieved. The key outcomes were then averaged over the 5,000 iterations, to determine the probabilistic burden of illness. The results were presented in the form of a histogram.

2.5 Scenario Analysis

Two scenario analyses were included in the model, an ‘earlier diagnosis’ scenario and an ‘alternative income loss for children’ scenario.

2.5.1 Earlier diagnosis scenario

An earlier diagnosis scenario was included in the model to explore the impact of achieving a reduction in average time until diagnosis for either malignant or non-malignant tumours. A scenario input was included in the model that could be used to specify the reduction in average time until diagnosis. In the base case this was set to two weeks. A base size of tumour was included which was intended to reflect the current average size of a malignant or non-malignant tumour at diagnosis. A monthly growth rate for malignant and non-malignant tumours was included which was applied to the reduction in time until diagnosis to estimate how much smaller the tumour would be from its current size. The impact of diagnosing a tumour that is smaller was captured through a reduction in inpatient bed days required and a reduction in mortality (see Section 3.6).

2.5.2 Alternative income loss method

The second scenario included in the model used alternative data to predict the future income loss associated with brain tumours diagnosed as a child. This was estimated using the proportion of future income loss for children with a brain tumour which was estimated from Pickering et al (2023) [5]. For a Danish population, they reported the income at age 30 years for the general population and for adults who had a malignant or non-malignant brain tumour as a child. The proportion of income loss was then applied to the UK average income at age 30 years to approximate the income lost in GBPs.

To ensure that the scenario captured only those alive at 30 and their relevant working years, survival until aged 30 was included. Furthermore, the scenario was only applied for working years up to the age of 30, given that long-term extrapolation was much more uncertain. This will result in a more conservative estimate of the impact.

No UK-specific evidence was identified for future income loss. As such, this approach using Danish data was used as scenario analysis to assess the robustness of the base case approach which used household income loss.

3 Model Parameters

This section outlines the inputs used to parameterise the model. Where possible, inputs were sourced from published studies or models. A clinical specialist was consulted to validate any assumptions made.

All inputs were stratified by tumour type (malignant or non-malignant) and age (adults or children) where possible. Where outcome data is not split by age or tumour type (e.g., household income lost with a brain tumour), it was assumed that the input value was generalisable across different characteristics.

3.1 Set-up

The population numbers used in the model were sourced from the Office for National Statistics (ONS) mid-2024 population estimates for the UK [6]. A yearly increase multiplier was calculated as the average percentage increase in population size per year for the past 5 years (mid-2020 to mid-2024) [7]. This multiplier was determined to be approximately 1.0079 and was applied to inflate the mid-2024 population estimate (69,281,437) to mid-2025. The proportion of the population over 18 was assumed to be constant over this one-year period. These inputs can be found in Table 3.1.

Table 3.1: Model Populations

Parameter	Parameter Value	Source
UK population size		
UK population	69,825,454	ONS (2025) [6]
UK population by age		
Proportion of UK aged <18	20.58%	ONS (2025) [6]
Proportion of UK aged 18+	79.42%	

Abbreviations: ONS – Office for National Statistics; UK – United Kingdom.

3.2 Incidence Rates

The yearly incidence of brain tumours in the UK was stratified by both tumour type and age using 2017 age-sex-standardised incidence values. Studies reporting benign and uncertain tumour types were grouped to inform non-malignant inputs in line with clinical advice.

Ali et al (2023) reported incidence rates for benign, uncertain, and malignant brain tumours in England which were used as proxies for the UK due to limited data availability [8]. Incidence rates were reported over several age groups. To calculate the incidences for adults, a weighted average was calculated using population numbers for each group. For children, the reported paediatric category (aged 0-14) was used as a proxy. The adult incidence rate and weightings can be found in Table 3.2 and the child incidence rate can be found in Table 3.3.

Abbreviations: ONS – Office for National Statistics; UK – United Kingdom.

Table 3.3

Table 3.2: UK Adult Incidence Rates

Parameter	Population size	Incidence per 100,000		Sources
		Malignant	Non-malignant	
Ages: 18-24	5,791,521	1.80	2.60	Ali et al (2023) [8] ONS (2025) [6]
Ages: 25-64	36,069,066	7.00	9.60	
Ages: 65-84	11,411,652	22.70	21.00	
Ages: 85 +	1,750,014	20.90	26.70	
Weighted Average for Adults in UK		**10.15**	**11.77**	

Abbreviations: ONS – Office for National Statistics; UK – United Kingdom.

Table 3.3 UK Children Incidence Rates

Tumour Type	Incidence per 100,000	Source
Malignant	2.20	Ali et al (2023) [8]
Non-malignant	2.00	

Abbreviations: ONS – Office for National Statistics; UK – United Kingdom.

3.2.1 Subgroup incidence rates

The yearly incidence rates were further stratified by country and deprivation level. Deprivation level was categorised using the Index of Multiple Deprivation (IMD) quintiles [9]. IMD is a measure of relative deprivation, based on the wider determinants of health (the social, economic, and environmental factors where people are born, live, work, and which significantly impact their health and wellbeing [10]). IMD quintile 1 refers to the most deprived quintile and IMD quintile 5 refers to the least deprived quintile.

Subgroup incidence rates were sourced from Cancer Research UK [11]. The incidence rates by country were based on 2019 data and the incidence rates by IMD were based on 2020 data. A weighted average of the male and female age-standardised rates for IMD incidence was calculated using the average number of cases per year as weightings. All incidence rates were assumed to remain the same in the current year due to limitations with data availability.

The country and deprivation quintile-specific incidence rates were weighted by the number of people in each subgroup to obtain a distribution of tumours across the different subgroups. The proportions of tumours belonging to each subgroup was then applied to the overall incident numbers in the UK (as above) to calculate the total number at the end of each terminal node for each country.

The population estimates for each country within the UK were sourced from the ONS mid-2024 populations [6]. The IMD population sizes were sourced from the most recent population estimates available for England from 2019. These populations were not inflated as the absolute value was not used for any calculations. Instead, the relative proportions within each subgroup were assumed to be constant over time. The IMD proportions for England were used as a proxy for the relative deprivation distribution across the UK.

Table 3.4 and Table 3.5 show the incidence rates divided by country and deprivation level, respectively.

Table 3.4: Incidence Rates by UK Country

Country	Population Size	Incidence per 100,000	Proportion of all tumours	Source
England	58,620,101	19.10	82.60%	Cancer Research (2019) [12] ONS (2025) [6]
Scotland	5,546,900	21.30	8.72%	
Wales	3,186,581	23.40	5.50%	
Northern Ireland	1,927,855	22.40	3.19%	

Abbreviations: ONS – Office for National Statistics.

Table 3.5: Incidence Rates by Deprivation Level

IMD Quintile	Population Size	Incidence per 100,000	Proportion of all tumours	Source
IMD Quintile: 1	11,267,059	18.82	20.43%	Cancer Research (2020) [13] ONS (2025) [6]
IMD Quintile: 2	11,576,973	18.48	20.93%	
IMD Quintile: 3	11,424,153	19.32	20.50%	
IMD Quintile: 4	11,117,694	19.47	19.08%	
IMD Quintile: 5	10,901,082	19.52	19.06%	

Abbreviations: IMD – Index of Multiple Deprivation; ONS – Office for National Statistics.

3.3 Costs

Where possible all costs were sourced from the National Cost Collection and published studies [14]. Where healthcare costs were taken from sources published before 2024, they were inflated to the 2023/24 cost-year using the using the Personal Social Services Research Unit (PSSRU) inflation indices [15]. If income data was from before 2025 it was inflated to August 2025 using the Bank of England inflation calculator [16].

3.3.1 Direct costs to the healthcare system

Direct costs to the healthcare system consisted of diagnosis and post-diagnosis costs. These can be found in Table 3.6. It was assumed that all individuals with a brain tumour were diagnosed in A&E or at the GP. The diagnosis costs also included the costs of different investigations (CT, MRI or biopsy). All MRI and CT costs were sourced from the National Cost Collection and were assumed to be in one area only, with contrast, and were stratified by age where possible [14]. The cost of a biopsy was assumed to be a weighted average of costs for image guided core needle biopsy of lesion of head or neck, and image guided fine needle aspiration of lesion of head or neck.

There are a variety of different biopsy types used for brain tumours dependent on tumour type and location. Although these are often coded as intracranial procedures, these codes also include more extensive and invasive procedures. The cost associated with a biopsy is therefore an overestimate as the reported costs are aggregated and cannot be separate by operation type. For this reason, the cost of a fine needle biopsy for lesion of head or neck has been used a conservative proxy for the biopsy cost for a brain tumour. This is likely an underestimate of the true cost.

The direct healthcare costs due to a malignant brain tumour were sourced from Garside et al (2007) and were applied for both adults and children [17]. These were inflated from 2007 to the 2023/24 cost year. A more recent source was not identified for this input which should be noted as a limitation within the model. Due to data availability, meningioma was used as a proxy for non-malignant brain tumours. Here, an average cost per person was calculated (where there was a cost of £163 million for 9,501 people). Furthermore, this only included inpatient costs.

The direct costs to the healthcare system are displayed in Table 3.6.

Table 3.6: Direct Costs to the Healthcare System

Parameter	Adults	Children	Source
Diagnosis Costs			
Proportion diagnosed in A&E	38.60%	38.60%	Cancer Research (2025) [18]
Diagnosis Location			
GP appointment	£45	£45	Jones et al (2025) [15]
A&E	£323	£323	Codes VB01Z-VB09Z National Cost Collection (2025) [14]
Investigation Cost			
CT with contrast	£116	£145	Codes RD21A-C and RD22Z National Cost Collection (2025) [14]
MRI with contrast	£201	£197	Codes RD02A-C and RD03Z National Cost Collection (2025) [14]
Biopsy	£351	£351	Codes YC01Z and YC02Z National Cost Collection (2025) [14]
Post-Diagnosis Costs			
Malignant	£24,590	£24,590	Table 53 Garside et al (2007) [17]
Non-malignant	£19,205	£19,205	P.11.41b. Kanso et al (2022) [19]
Total (Lifetime) Direct Healthcare Costs			
Total (Malignant)	£25,410	£25,435	Calculation
Total (Non-malignant)	£20,025	£20,050	

Abbreviations: A&E – Accident and Emergency; CT – computed tomography; GP – general practitioner; MRI – magnetic resonance imaging.

3.3.2 Household income lost whilst alive

Household income lost whilst alive was assumed to be generalisable across both tumour type and age. This cost was taken to include the income loss of an individual with a brain tumour and the income loss of other household members due to caring responsibilities. For adults with a brain tumour and for children with a malignant brain tumour, this cost was applied for the remaining life years post diagnosis. For children with non-malignant brain tumours, this cost was only applied until the individual reached 18 years of age. The average age of a child with a non-malignant brain tumour (9.1 years (NICE 2023)) was then subtracted from 18 [20]. It was assumed that upon reaching 18, there would be no impact to household income for the remainder of their lives. An alternative approach was assessed in scenario analysis (see Section 2.5.2). The household income lost whilst alive is displayed in

Table 3.7. For household income lost whilst alive the model includes the functionality to specify different household income loss by age and/or tumour group. This income loss is applied for 6 years for a non-malignant child tumour. This is based on a calculation where the average starting age of a child non-malignant brain tumour (12.1) is subtracted from the 18 [20].

Table 3.7: Annual Household Income Lost Whilst Alive

Parameter	Parameter Value	Source
Household income lost whilst alive	£20,848	Perkins et al (2018) [21]

3.3.3 Income lost due to premature death

Income lost due to premature death was calculated by multiplying years of potential labour productive life lost (YPLPLL) by the mean annual UK income. Darbà and Ascanio (2025) reported the YPLPLL for adults with a malignant brain tumour [22]. This study was Spanish and so the YPLPLL was assumed to be generalisable to the UK population, in the absence of alternative evidence. The YPLPLL for males and females was summed and then divided by the total number of reported deaths to create a per person labour productive life loss. This was then multiplied by the average UK earnings sourced from the ONS (2024) [23]. The YPLPLL for adults with a malignant brain tumour was used as a proxy for adults with a non-malignant brain tumour. The average YPLPLL may be lower than expected since a substantial number of deaths in this study occurred in older people and post-retirement years do not count as labour productive life years.

For children with malignant brain tumours, their YPLPLL was assumed to be the expected duration of working life in the UK. For, children with non-malignant brain tumours their average age combined with their expected life years post-diagnosis was subtracted from the retirement/pension age of 67. This calculated the years of working age between their life expectancy and retirement age. This was then scaled using the average employment percentage of the economically active population in the UK. These inputs are displayed in Table 3.8.

Table 3.8: Income Lost due to Premature Death

Parameter	Adults	Children	Source
Malignant	4.94 years	39.20 years	Darbà et al (2025) [22] Powell et al (2025) [24]
Non-malignant	4.94 years	9.89 years	
UK mean income	£38,224		ONS (2024) [23]

Abbreviations: ONS – Office for National Statistics; UK – United Kingdom.

3.3.4 Welfare system annual costs

Perkins et al (2018) reported that households where an individual has a brain tumour receive welfare benefits of £4,767 on average [21]. To calculate the mean welfare benefit of the UK population, the state pension was subtracted from the total benefit expenditure in the UK. This was then divided by the scaled mid-2025 population estimate for the UK. The mean welfare benefit of the UK general population was subtracted from the mean welfare benefit with a brain tumour to calculate the average additional benefits received due to the brain tumour. This was applied for the individual’s lifetime. It should be noted that this input was reflective of a household. These are displayed in Table 3.9.

Table 3.9: Welfare System Annual Costs Inputs

Parameter	Adults	Children	Source
Mean welfare benefit with a brain tumour	£6,271		Perkins et al (2018) [21]
Mean welfare benefit of UK general population	£2,158		Outturn forecast tables: Spring Statement 2025 (XLS): Table 1a GOV.UK (2025) [25]
Average additional benefit received	£4,113		Calculation

Abbreviations: UK – United Kingdom.

3.3.5 Additional care requirement costs

Additional care requirement costs were included in the analysis to account for excess household spending, unrelated to direct treatment costs. The additional monthly spend on care was sourced from Perkins et al (2018) and inflated to 2025 values using the Bank of England inflation calculator [16, 21]. The additional monthly spending input was only applied whilst an individual received treatment. The duration of treatment was an assumption and based on clinical advice. Additional monthly spending was assumed to be equal among adults and children. These costs are presented in Table 3.10.

Table 3.10: Additional Care Requirement Cost Inputs

Parameter	Additional Monthly Spending	Duration of Treatment	Total Additional Spending	Source
Malignant	£797	5.0 months	£3,985	Perkins et al (2018) [21]
Non-malignant	£797	10.0 months	£7,970	

3.3.6 Alternative income loss scenario

The model includes an alternative future income loss scenario for children with a brain tumour. The inputs for this scenario are displayed in Table 3.11. The proportion of annual income loss was calculated from Pickering et al (2023) [5]. The income loss data at 30 years of age was observed in Denmark and has been used as a proxy for the UK. The calculated proportion lost was multiplied by expected UK income to calculate the annual income lost. This income loss was only applied to those surviving until 30, consistent with the age in the source from which the input is estimated. Assuming a starting age of 18, this equates to 12 years of proportional income loss for the survivors.

A 10-year crude survival rate was sourced for the child malignant survival rate. This was then applied to the mean age of 12 to provide an estimate for survival by age 22. Between the ages of 22 and 30, annual population norm mortality was applied [26] . The 10-year crude survival rate was sourced from England and Wales and is used as a proxy for the UK.

A weighted average of the mean UK income for ages 18 to 29 was calculated using the mean annual data pay split by region and age group provided by the ONS and Northern Ireland Statistics and Research Agency (NISRA) [23, 27]. These were weighted using the number of jobs (thousands) per region.

Table 3.11: Alternative Income Loss Scenario Inputs

Parameter	Parameter Value	Source
Years of Income Loss		
Years of income loss	12 years	Calculated assuming employment begins at 18 and the loss applies until 30 years of age.
Future Income Lost for Children with Malignant Brain Tumours		
Proportion of annual income lost due to malignant brain tumour as a child	39.00%	Table 3 Pickering et al (2023) [5]
Survival at 30 years of age	49.03%	Tseng et al (2006) [28] ONS (2025) [6]
Future Income Lost for Children with Non-Malignant Brain Tumours		
Proportion of annual income lost due to non-malignant brain tumour as a child	4.00%	Table 3 Pickering et al (2023) [5]
Survival at 30 years of age	64.00%	NICE (2023) [20]
Mean UK Income for Ages 18 to 29		
Mean income (<30 years old)	£28,310	ONS (2024) [23] NISRA (2024) [27]

Abbreviations: NICE – National Institute for Health and Care Excellence; NISRA – Northern Ireland Statistics and Research Agency; ONS – Office for National Statistics; UK – United Kingdom.

3.4 Health Impacts

To calculate the QALY and life years inputs, population norms were used. These were calculated using background mortality (ONS 2025) and expected annual EQ-5D-3L score (NICE 2022)). These were then matched to the average age of tumours [26, 29] . These baseline characteristics are displayed in Table 3.12.

Table 3.12: Expected Life Years and QALYs for a Matched General Population

Parameter	Average Age	Source	Life Years	Source	QALYs	Source
Adult: malignant	59.4	Watanabe et al (2022) [30]	24.29	Calculation	19.09	Calculation
Adult: Non-malignant	61.8		21.73		16.92	
Child: malignant	12.1	NICE (2023) [20]	71.92		62.17	
Child: Non-malignant	9.1		68.93		59.40	

Abbreviations: NICE – National Institute for Health and Care Excellence; QALY – quality-adjusted life year.

3.4.1 QALYs for brain tumour population

The QALY inputs for adults and children are presented in Table 3.13 and Table 3.14 respectively. The QALYs accrued and QALYs lost were calculated using utility scores. The utility scores were observed in Japan and were used as a proxy for the UK population in this analysis. A weighted average was used to calculate the utility for a malignant tumour using the utility for a glioblastoma, utility for a World Health Organisation (WHO) Grade 3 tumour and the utility of a primary central nervous system lymphoma. The utility used for non-malignant was the utility representative of a WHO grade I tumour. The accrued QALYs were calculated by multiplying the utilities by the expected life years for each tumour type (see Section 3.4.2). The QALYs lost were calculated by subtracting the QALYs accrued in the brain tumour group from the expected QALY norms from a matched population (Table 3.12).

Table 3.13: QALY Inputs for Adults

Parameter	Utility Score	Source	QALYs Accrued	Source	QALYs Lost	Source
Malignant	0.63	Watanabe et al (2022) [30]	2.66	Calculation	16.43	Calculation
Non-malignant	0.76		5.75		11.17	

Abbreviations: QALY – quality-adjusted life year.

A QALY shortfall was used when calculating the QALY inputs for children. The proportional QALY shortfall reflects the relative reduction in expected QALYs for the brain tumour group, relative to a general population matched on age and sex. The QALYs lost were calculated by multiplying the QALY shortfall and population QALY norms (see Table 3.12).

Table 3.14: QALY Inputs for Children

Parameter	QALY Shortfall	Source	QALYs Lost	Source
Malignant	96.90%	NICE (2023) [20]	60.24	Calculation
Non-malignant	52.80%		31.36	

Abbreviations: NICE – National Institute for Health and Care Excellence; QALY – quality-adjusted life year.

3.4.2 Life years for brain tumour population

The life years inputs are displayed in Table 3.15 and Table 3.16. Average life years lost for adults were sourced for Rouse et al (2016) [31]. Estimated life years were subsequently calculated by subtracting the estimated life years lost in this population from the expected life years in the matched general population.

Table 3.15: Life Years Inputs for Adults

Parameter	Estimated Life Years	Source	Life Years Lost	Source
Malignant	20.08	Calculation	4.21	Rouse et al (2016) [31]
Non-malignant	14.19		7.54	

The estimated life years lost for the child brain tumour groups were calculated by subtracting the estimated life years from the expected life years of the general population.

Table 3.16: Life Years Inputs for Children

Parameter	Estimated Life Years	Source	Life Years Lost	Source
Malignant	1.28	NICE (2023) [20]	70.64	Calculation
Non-malignant	47.52		21.41	

Abbreviations: NICE – National Institute for Health and Care Excellence.

3.5 Education

Data from Pickering et al (2023) was used to calculate the relative proportion of education completed for people with a brain tumour compared to people without a brain tumour [5]. The proportion of the UK population with no qualifications or bachelors or above (ONS 2023) was multiplied by the relative proportion to calculate the proportion of educational attainment for malignant and non-malignant tumours [32]. Educational attainment is presented in Table 3.17.

Table 3.17: Attainment for Malignant Brain Tumours Inputs

Education Completed Aged 30 Years	Proportion of Tumour: Malignant	Proportion of Tumour: Non-malignant	Source	Proportion of UK Population	Source
No qualifications	46.45%	25.96%	Pickering et al 2023 [5]	18.20%	ONS (2023) [32]
Bachelor’s and above	18.71%	36.48%		33.80%	

Abbreviations: ONS – Office for National Statistics.

3.6 Earlier Diagnosis Scenario

An earlier diagnosis scenario was included in the model which explored the impact of a change in tumour size from earlier diagnosis if all other factors e.g. tumour location remained unchanged. The reduction in average time until diagnosis was assumed to be 2 weeks. This can be manually edited to explore the impact of reducing the average time until diagnosis. A baseline tumour size from Gray et al (2025) was included to reflect the current average size of a malignant/non-malignant brain tumour at diagnosis [33]. A monthly growth rate was included which was applied to the change in time until diagnosis to estimate how much smaller the tumour would be from the current size. The monthly growth rate for malignant tumours was 52.68% and was 1.67% for non-malignant tumours [34, 35]. The impact of diagnosing a tumour that is smaller will then be estimated.

To measure the impact on costs an annual reduction in bed days was used as a multiplier. For each 1 cm reduction in tumour size, the healthcare costs were reduced by 1.51 (malignant)/1.50(non-malignant). Health outcomes (i.e. QALYs and life years) were impacted by decreases in mortality. For each 1 cm reduction in tumour size, life expectancy increases by 1.11 days (malignant) or 1.09 days (non-malignant). These inputs can be found in Table 3.18.

Table 3.18: Estimating Reduction in Tumour Size

Parameter	Estimated reduction in tumour size	Source	Additional Bed Days Required per 1cm Size Increase	Source	Mortality Hazard Ratio per 1cm Size Increase	Source
Malignant	0.90cm	Calculation	1.51 days	Gray et al (2025) [33]	1.11	Gray et al (2025) [33]
Non-malignant	0.03cm		1.50 days		1.09	

4 Results

4.1 Base Case

A summary of the base case results for the UK is displayed in Table 4.1. Outcomes are presented for the population and on a per tumour basis. Of the 12,761 tumours diagnosed in 2025, they were estimated to incur a £18.7 billion burden to the UK economy over their lifetime. On average, 15.16 QALYs and 18.35 life years were lost per tumour.

Table 4.1: Summary of Base Case Results

	Base Case	Per Tumour
Financial costs	£5,165,364,123	£404,787
Monetary value of QALYs lost	£13,543,407,406	£1,061,339
Total QALYs lost	193,477	15.16
Total life years lost	234,151	18.35
Burden of Illness	**£18,708,771,529**	**£1,466,126**

Abbreviations: QALY – quality-adjusted life year.

Table 4.2 displays the breakdown of the burden of illness. The monetary value of QALYs lost contributes to 72.39% of the total burden. The second highest contributor is income lost due to premature death. These are likely related to the high mortality associated with brain tumours. The lowest contributor is the additional care requirement costs. This cost is only applied for the duration of treatment and is, therefore, much smaller. In reality, care requirements may continue well after treatment has finished.

Table 4.2: Burden of Illness Breakdown

	Burden	Percentage of Burden
Direct healthcare costs	£287,567,640	1.54%
Household income lost while alive	£1,564,058,925	8.36%
Income lost due to premature death	£2,877,939,812	15.38%
Welfare system costs	£357,787,461	1.91%
Additional care requirement costs	£78,010,286	0.42%
Monetary value of QALYs lost	£13,543,407,406	72.39%

Total	**£18,708,771,529**	**100.00%**

Abbreviations: QALY – quality-adjusted life year.

The total incident tumours predicted in the model are presented in Table 4.3. Adults have more incident tumours compared to children which is due to them having a big population size and higher incidence rates.

Table 4.3: Total Incident Tumours

	Malignant	**Non-malignant**
Adults	5,629	6,528
Children	316	287
Total Incident Tumours	**5,945**	**6,815**

Table 4.4 shows the age breakdown of the key results. 85.75% of the burden of illness is from adults. This is due to the higher incidence of tumours in adults.

Table 4.4: Age Breakdown

	Adults	**Adults: Per Tumour**	**Children**	**Children: Per Tumour**
Financial costs	£4,464,156,610	£367,204	£701,207,513	£1,161,818
Monetary value of QALYs lost	£11,579,234,363	£952,464	£1,964,173,042	£3,254,403
Total QALYs lost	165,417.63	13.61	28,059.61	46.49
Total life years lost	205,666.09	16.92	28,484.52	47.20
Burden of Illness	**£16,043,390,974**	**£1,319,668**	**£2,665,380,555**	**£4,416,221**

Abbreviations: QALY – quality-adjusted life year.

4.1.1 Educational Impact

Table 4.5 displays the education results. The expected values refer to the expected number of no qualifications or bachelor's and above for a cohort of equivalent size with general population attainment. The estimated values refer to the estimated number from the predicted brain tumour population. The results highlight that people with brain tumours are more likely to have no qualifications than people without brain tumours. This difference is considerably higher in people with malignant tumours. In addition, they are less likely to have bachelor's degree or above than people without brain tumours.

Table 4.5: Highest Estimated Educational Level

	Expected for matched population	**Estimated for brain tumour population**	**Change in Percentage**
No qualifications			
Malignant	58	141	145.48%
Non-malignant	52	72	37.21%
Bachelor's and above			
Malignant	107	64	-39.70%
Non-malignant	97	83	-14.66%

4.2 Subgroups

The results were also stratified by country in the UK and deprivation level. The only input from the base case that changed was incidence, given the data limitations.

4.2.1 Countries

When stratified by country the distribution of the burden of illness for each country within the UK was primarily influenced by the population size of that country. England had a slightly lower burden of illness relative to its population size, whereas the opposite was observed for the other countries.

4.2.2 Deprivation

The results for each deprivation group are displayed in Table 4.6, with the distribution of burden of illness displayed in Table 4.7. The least deprived groups (IMD quintiles 4 and 5) incur an additional £57 million burden of illness compared to the most deprived groups (IMD quintiles 1 and 2). This suggests that people who are more deprived may be disproportionately affected by brain tumours. However, given the relative size of the burden, the relative impact is broadly flat across IMD quintiles.

Table 4.6: Burden of Illness by Deprivation Group

	IMD Quintile 1	**IMD Quintile 2**	**IMD Quintile 3**	**IMD Quintile 4**	**IMD Quintile 5**
Financial costs	£1,018,153,474	£1,026,834,314	£1,059,619,337	£1,039,051,124	£1,021,705,873
Monetary value of QALYs lost	£2,669,563,456	£2,692,324,321	£2,778,285,526	£2,724,356,378	£2,678,877,725
Total QALYs lost	38,1367	38,462	39,690	38,919	38,270
Total life years lost	46,154	46,547	48,034	47,101	46,315
Burden of Illness	**£3,687,716,931**	**£3,719,158,635**	**£3,837,904,863**	**£3,763,407,502**	**£3,700,583,599**

Abbreviations: IMD – Index of Multiple Deprivation, QALY – quality-adjusted life year.

Table 4.7: Distribution of Burden of Illness by Deprivation Group

	IMD Quintile 1	**IMD Quintile 2**	**IMD Quintile 3**	**IMD Quintile 4**	**IMD Quintile 5**
Percentage of UK Population	20.02%	20.57%	20.30%	19.75%	19.37%
Percentage of Total Burden of Illness	19.71%	19.88%	20.51%	20.12%	19.78%

Abbreviations: IMD – Index of Multiple Deprivation.

4.3 Scenario Analysis

4.3.1 Earlier Diagnosis

The results of the earlier diagnosis scenario are displayed in Table 4.8. For a 2-week reduction in average time until diagnosis, the burden of illness reduces by £802 million (a 4.29% decrease). This percentage change is relative to the base case burden.

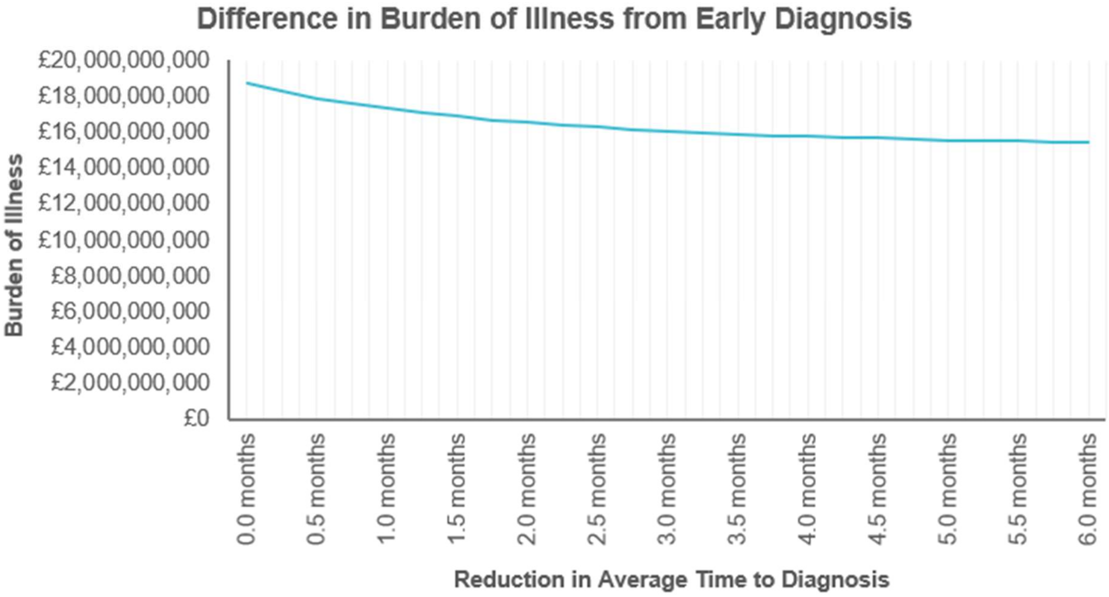
Table 4.8: Earlier Diagnosis Scenario Results

	Total Change	Percentage Change
Change in financial costs	-£89,656,057	-1.74%
Change in monetary value of QALYs lost	-£712,527,385	-5.26%
Change in Burden of Illness	**-£802,183,441**	**-4.29%**

Abbreviations: QALY – quality-adjusted life year.

Figure 4.1 shows how a reduction in average time until diagnosis for both malignant and non-malignant tumours would impact the total burden of illness of brain tumours. This graph includes an average reduction time of 0-6 months. This was based on reporting that glioblastomas may be present 3-6 months prior to symptoms [35]. However, this does not mean that a six-month average reduction in diagnosis time would be clinically plausible, so longer reductions should be considered with caution. The graph shows diminishing marginal returns as the reduction in the delay until diagnosis increases. This highlights how a higher proportion of the benefit may be achieved in the initial reductions in diagnosis time.

Figure 4.1: One-way Sensitivity Analysis



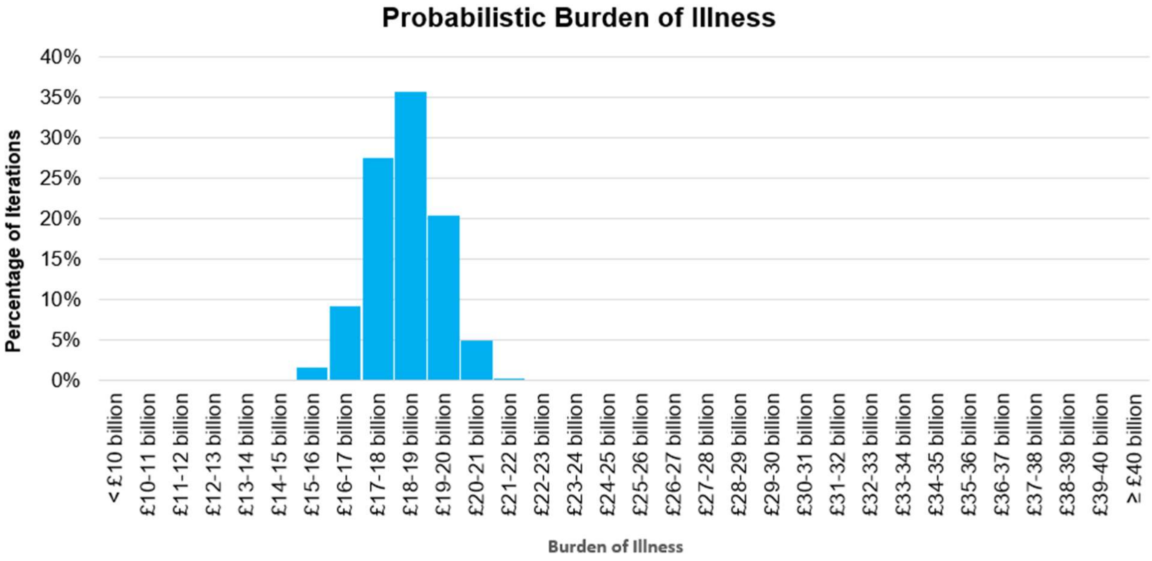
4.3.2 Alternative income loss method

The alternative income loss method scenario results was also calculated. When the alternative method to calculating income loss was used, the burden of illness reduces to £18.4 billion. This was a reduction of £268 million, so did not substantially impact the overall results.

4.4 Probabilistic Sensitivity Analysis

The mean burden of illness was £18.3 billion (95% credible intervals: £16.5 billion to £20.0 billion). Figure 4.2 presents the probabilistic burden of illness. For 35.72% of iterations the burden of illness was between £18 and £19 billion. PSA convergence was met (shown in Figure B.1).

Figure 4.2: Probabilistic Burden of Illness



5 Discussion

The lifetime burden of illness of brain tumours diagnosed in the UK in 2025 is estimated to be approximately £18.7 billion. This value reflects the substantial impact that brain tumours have on society. These results align with other research pieces. Fineberg et al (2013) and Li et al (2025) both found that the indirect costs of brain tumours (i.e. monetary value of QALYs) are considerably higher than the direct health and social care costs [36, 37]. Furthermore, the methods used in this analysis align with other research. Li et al (2025) multiplied disability adjusted life years by a willingness to pay threshold to calculate indirect costs [37]. This method is similar to the monetary value of QALYs lost method used in this analysis. The monetary value of QALYs lost was the key driver to a high burden. To calculate the monetary value, QALYs were multiplied by £70,000 as per the treasury Green Book [4].

When there was a two-week reduction in average time until diagnosis, the burden of illness reduced by £802 million (a 4.29% decrease). Gray et al (2025) found that, when tumour size was larger at diagnosis, mortality, expected inpatient stay length and odds of a new or worsened neurological deficit increased. When mortality is increased the burden of illness will increase through larger QALY decrements and higher YPLPLL. Furthermore, increasing inpatient stay length increases direct healthcare costs, while inpatient beds are of limited capacity in the NHS over the past decade [38]. New or worsened neurological deficit decreases health related quality of life and likely impact an individual's ability to work. An earlier diagnosis would reduce these impacts. Earlier diagnosis presents one route to reduce the burden of illness associated with brain tumours.

The analysis also found that IMD Quintile 3 had the highest burden of illness with IMD Quintile 1 (most deprived) having the lowest burden of illness. However, relative to the overall burden, the differences by IMD group were small, suggesting other factors are likely to impact the incidence of brain tumours. This is in line with other studies which have reported a higher incidence of brain tumours in areas of higher socioeconomic status, but not statistically significantly different [39].

Previous studies have considered reasons for incidence not being associated with differences by socioeconomic status. For example, it may be the risk of brain tumours are driven substantially by genetic factors [40, 41]. Studies have found that ethnicity is a significant factor in the incidence of brain tumours, with white people having a higher incidence of brain tumours and a greater mortality risk [42, 43].

The analysis did not consider differences in outcomes according to IMD quintile. Whilst not explored, it is known that more deprived populations may struggle to access healthcare, therefore delaying diagnosis and treatment [44]. More deprived populations are likely to have a higher burden of illness because of this compared to less deprived populations. This is due to the impacts of delayed diagnosis and delayed treatment, worsening symptoms and mortality risk.

Household income loss was the third highest contributor to the overall burden of illness (8.36%). This cost is driven by people with a brain tumour reducing their working hours or taking sick leave, which also decreases productivity in the workforce. Support post treatment to encourage individuals to go back to work would be important to decreasing the overall burden. This aspect of the burden is an important consideration, given workplace productivity is a priority for the UK government and support mechanisms for people with brain tumours will contribute towards that.

One key area of the burden, not captured within the £18.7 billion figure is the impact on education. People with brain tumours are less likely to have a bachelor's degree or above and more likely to have no qualifications. Studies have shown that having no qualifications significantly affects your potential lifetime earnings. A 2020 study [45] found the average discounted difference in lifetime earnings for graduates and non-graduates to be £430,000 for men and £260,000 for women. The model did not explicitly capture the outcomes of differences in educational attainment. However, it may have captured some of the impact of education through the scenario which calculates future income loss for children who currently have brain tumours. Despite the educational impact being greater for those with malignant tumours, this may be more consequential for those with non-malignant brain tumours since their average life expectancy is longer. This highlights the importance of educational support for children with brain tumours.

A range of policies could be considered to reduce the burden associated with brain tumours. However, the relative resource use should be considered alongside the opportunity cost (forgone value) of spending elsewhere. Brain tumours are estimated to have a substantial burden to the UK economy, and as such, policies to reduce that burden should be considered.

5.1 Strengths and Limitations

There were two key limitations associated with this analysis, lack of robust data sources for aspects of the model and omitted factors where no evidence is available. Household income lost whilst alive contributed 8.36% of the total burden of illness. This should be taken with caution as the input informing this was applied for all brain tumour types and all ages in the model despite potential differences across groups. Furthermore, the input source was less robust than other inputs in the model. To test the robustness of this source, an alternative scenario for income loss in children was used. When this scenario was used, the burden of illness reduced by £269 million. This reduction highlights, that despite the household income loss being a less reliable source and less reflective for all groups, using a different source or method does not change the overall results and narrative.

The results of this analysis omit important factors due to data limitations. Therefore, it is likely that the burden of illness is higher than estimated figures. The pathway model stratified brain tumours by type (malignant and non-malignant) and by age. For many impacts of brain tumours, this was not possible to quantify, e.g. household income loss. For these inputs, it was assumed that the input was the same among malignant and non-malignant tumours and for adults and children. It is known that many inputs differ by tumour type and age and, therefore, in these instances the costs applied are uncertain. Furthermore, due to a lack of available data outcomes were not broken down to specific tumour types.

Finally, the direct healthcare costs are likely to be higher than reported. One reason for this is that palliative care costs were not included. These costs are likely to be substantial because many brain tumours are terminal, so require further intensive care over the rest of a person's life. Outpatient costs for non-malignant brain tumours were also not included due to lack of available data. It is unlikely though that the inclusion of palliative care costs and outpatient costs will change the overall estimates, simply, the overall burden of illness would be expected to increase.

Overall, many of the limitations highlight that the burden associated with brain tumours may be higher than estimated. This also highlights the importance of future research into the impact of brain tumours, to understand the mechanisms which impact people on day-to-day life, and the impact this has on the wider economy. A greater understanding of the burden of brain tumours will also help to inform future policies, which can start to decrease the burden to society.

6 Conclusion

The analysis estimated that 12,761 people will be diagnosed with a brain tumour in 2025, which will lead to an £18.7 billion burden to the UK economy over their lifetimes. This result is largely driven by the monetary value of QALYs lost through premature mortality. Scenario analysis revealed that reducing average diagnosis time has the potential to reduce the burden of illness.

Future evidence generation will be important for future analysis to better understand the burden that brain tumours have on society, as well as design policies to best reduce the burden. This includes further evidence on the direct healthcare costs and household income loss of brain tumours, and greater evidence on the value of early diagnosis.

7 References

1. The Brain Tumour Charity. The statistics about brain tumours [cited 22/10/2025 Available from: https://www.thebraintumourcharity.org/get-involved/donate/why-choose-us/the-statistics-about-brain-tumours/.

2. Rough EaS, N. Brain tumour research funding 2023. Available from: https://commonslibrary.parliament.uk/research-briefings/cdp-2023-0057/.

3. York Health Economics Constortium. Quality-adjusted life year (QALY). 2015. [cited 31/10/2025 Available from: https://www.yhec.co.uk/glossary-term/quality-adjusted-life-year-qaly/.

4. GOV.UK. The Green Book. In; 2022

5. Pickering L, Main KM, Feldt-Rasmussen U, Sehested A, Mathiasen R, Klose M*, et al.* Survival and long-term socioeconomic consequences of childhood and adolescent onset of brain tumours. Developmental Medicine & Child Neurology. 2023.65(7):942-52. doi: https://doi.org/10.1111/dmcn.15467

6. Office for National Statistics. Estimates of the population for the UK, England, Wales, Scotland, and Northern Ireland. In. Mid-2024 ed; 2025

7. Office for National Statistics. UK population estimates 1838 to 2024 edition of this dataset. In; 2025

8. Ali AMW, D R.; Judge AD.; Plaha, P.; Darby, S C. Temporal trends in the incidence of malignant and nonmalignant primary brain and central nervous system tumors by the method of diagnosis in England, 1993-2017. Neuro Oncology. 2023.25(6):1177-92. doi: 10.1093/neuonc/noad001

9. Office for National Statistics. Population by Index of Multiple Deprivation (IMD), England, 2001 to 2019. In; 2020

10. GOV.UK. English indices of deprivation. 2019. [cited 22/10/2025 Available from: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019.

11. Cancer Research UK. Brain, other CNS and intracranial tumours incidence statistics. 2025. [cited 10/09/2025 Available from: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/brain-other-cns-and-intracranial-tumours/incidence#heading-Zero.

12. Cancer Research UK. Brain, other CNS and intracranial tumours statistics. 2019. [cited 14/08/2025 2025]. Available from: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/brain-other-cns-and-intracranial-tumours.

13. Cancer Research UK. Brain, other CNS and intracranial tumours incidence statistics. 2020. [cited 14/08/2025 Available from: https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/brain-other-cns-and-intracranial-tumours/incidence#heading-Five.

14. NHS England. 2023/24 National Cost Collection data. 2025. [cited 11 Sep 2025]. Available from: https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection/.

15. Jones and Weatherly, Helen and Birch, Sarah and Castelli, Adriana and Chalkley, Martin and Dargan, Alan and Findlay*, et al.* Unit Costs of Health and Social Care 2024 Manual. 2025. Available from: https://www.pssru.ac.uk/unitcostsreport/.

16. Bank of England. Inflation Calculator. 2025. [cited 19/08/2025 Available from: https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator.

17. Garside R, Pitt M, Anderson R, Rogers G, Dyer M, Mealing S*, et al.* The effectiveness and cost-effectiveness of carmustine implants and temozolomide for the treatment of newly diagnosed high-grade glioma: a systematic review and economic evaluation. Health technology assessment (Winchester, England). 2007.11(45):iii-iv, ix-221. doi: 10.3310/hta11450

18. Cancer Research UK. Early Cancer Diagnosis Data Hub. 2025. [cited 14/08/2025 2025]. Available from: https://crukcancerintelligence.shinyapps.io/EarlyDiagnosis/_w_989d97fe98424eb2ab4f26cd581c301d/?Tab=hometab.

19. Kanso N, Le Calvez K, Mauricaite R, Williams M. P11.41.B The Cost of Inpatient Care For Adult Primary Brain Tumour Patients in England: Neuro Oncol. 2022 Sep 5;24(Suppl 2):ii66-7. doi: 10.1093/neuonc/noac174.230. eCollection 2022 Sep.; 2022.

20. National Institute for Health and Care Excellence. Single Technology Appraisal: Dabrafenib with trametinib for treating BRAF V600E mutation-positive glioma in children and young people aged 1 to 17[ID5104]. Committee Papers. 2023. Available from: https://www.nice.org.uk/guidance/ta977/evidence/committee-papers-pdf-13430212093.

21. Perkins N, Murigi E. Brain Tumours A cost too much to bear?: Brain Tumour Research; 2018. Available from: https://www.bnos.org.uk/wp-content/uploads/2018/12/Brain-Tumours-a-cost-too-much-to-bear-Nov-2018.pdf.

22. Darbà JA, M. Economic consequences of premature mortality due to brain cancer in Spain: a human capital approach. Current Medical Research and Opinion. 2025.41(6):949-58. doi: https://doi.org/10.1080/03007995.2025.2538755

23. Office for National Statistics. Earnings and hours worked, UK region by age group. 2024. [cited 14/08/2025 2025]. Available from: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/earningsandhoursworkedukregionbyagegroup.

24. Powell A, Zaidi K, Murray A. Unemployment in the UK: Economic indicators. UK Parliament: House of Commons Library; 2025. [cited 13 October 2025]. Available from: https://commonslibrary.parliament.uk/research-briefings/sn02797/.

25. GOV.UK. Benefit expenditure and caseload tables 2025. In; 2025

26. Office for National Statistics. National life tables: UK. 2025. [cited 11/09/2025 Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/datasets/nationallifetablesunitedkingdomreferencetables/current.

27. Northern Ireland Statistics and Research Agency (NISRA). ASHE tables in ODS. 2024. [cited 14/08/2025 2025]. Available from: https://www.nisra.gov.uk/publications/ashe-tables-ods.

28. Tseng J-H, Tseng M-Y. Survival Analysis of Children with Primary Malignant Brain Tumors in England and Wales: A Population-Based Study. Pediatric Neurosurgery. 2006.42(2):67-73. doi: 10.1159/000090458

29. NICE Decision Support Unit. Estimating EQ-5D by age and sex for the UK. 2022. [cited 11/09/2025 Available from: https://sheffield.ac.uk/nice-dsu/methods-development/estimating-eq-5d.

30. Watanabe TN, S.; Natsumeda, M.; Kimura, S.; Tabata, S.; Ikarashi, F.; Takano, M.; Tsukamoto, Y.; Oishi, M. Characteristics of health-related quality of life and related factors in patients with brain tumors treated with rehabilitation therapy. Journal of Patient-Reported Outcomes. 2022.6(94)doi: 10.1186/s41687-022-00499-y

31. Rouse CG, H.; Ostrom, Q.; Kruchko, C.; Barnholtz-Sloan, J. . Years of potential life lost for brain and CNS tumors relative to other cancers in adults in the United States, 2010. Neuro Oncology. 2016.18(1):70-77. doi: 10.1093/neuonc/nov249

32. Office for National Statistics. Education, England and Wales: Census 2021. 2023. [cited 16/09/2025 Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/educationandchildcare/bulletins/educationenglandandwales/census2021.

33. Gray EC, J.; Lishman, A.; Hall, P.; Karunaratne, P.; Tramonti, G.; Vallet, M.; Pike, L.; Baker, M.; Brennal, P M. . Does earlier diagnosis and treatment of brain tumours matter? Time-to-treatment intervals and tumour size at detection; impact on survival, recurrence, inpatient length of stay and neurological deficit. 2025.doi: https://doi.org/10.1101/2025.06.23.25330109

34. Ankush Bhatia RMASR, Subhiksha Nandakumar, Henry S. Walch, Teena M. Thomas, Philip J. Nicklin, Ye Choi, Anna Skakodub, Rachna Malani, Vivek Prabhakaran, Pallavi Tiwari, Maria Diaz, Katherine S. Panageas, Ingo K. Mellinghoff, Tejus A. Bale, Robert J. Young Tumor Volume Growth Rates and Doubling Times during Active Surveillance of IDH-mutant Low-Grade Glioma. Clinical Cancer Research. 2024.30(1):106-15. doi: https://doi.org/10.1158/1078-0432.CCR-23-1180

35. Anne Line Stensjøen OS, Kjell Arne Kvistad, Asta K. Håberg, Øyvind Salvesen, Erik Magnus Berntsen. Growth dynamics of untreated glioblastomas in vivo. Neuro Oncology. 2015.17(10):1402-11. doi: https://doi.org/10.1093/neuonc/nov029

36. Fineberg NA HP, Carpenter L, Gannon B, Sharpe R, Young AH, Joyce E, Rowe J, Wellsted D, Nutt DJ, Sahakian BJ. The size, burden and cost of disorders of the brain in the UK. Journal of Psychopharmacology 2013.27(9):761-70. doi: 10.1177/0269881113495118

37. Jönsson YLaL. The health and economic burden of brain disorders: Consequences for investment in diagnosis, treatment, prevention and R&D. Cerebral Circulation - Cognition and Behaviour. 2025.8doi: https://doi.org/10.1016/j.cccb.2025.100377

38. Ewbank LT, J; McKenna, H; Anandaciva, S; Ward, D. NHS Hospital Bed Numbers. The King's Fund; 2021. [cited 13/11/2025 Available from: https://www.kingsfund.org.uk/insight-and-analysis/long-reads/nhs-hospital-bed-numbers.

39. Cote DJ OQ, Gittleman H, Duncan KR, CreveCoeur TS, Kruchko C, Smith TR, Stampfer MJ, Barnholtz-Sloan JS. Glioma incidence and survival variation by county-level socioeconomic measures. Cancer 2019.125(19):3390-400. doi: 10.1002/cncr.32328

40. Cancer Research UK. Risks and causes of brain tumours. 2023. [cited 12/11/2025 Available from: https://www.cancerresearchuk.org/about-cancer/brain-tumours/risks-causes.

41. NHS. Brain Tumours. 2023. [cited 12/11/2025 Available from: https://www.nhs.uk/conditions/brain-tumours/.

42. King's College London. Ethnicity could play a role in surviving brain tumours, study finds. 2021. [cited 12/11/2025 Available from: https://www.kcl.ac.uk/news/does-ethnicity-play-a-role-in-survival-from-brain-tumours.

43. Monterroso PM, K J; Sample, J M; Sorajja, N; Domingues, A; Williams, L A. Racial/ethnic and sex differences in young adult malignant brain tumor incidence by histologic type. Cancer Epidemiology 2022.76doi: https://doi.org/10.1016/j.canep.2021.102078

44. The King's Fund. What are health inequalities? 2025. [cited 12/11/2025 Available from: https://www.kingsfund.org.uk/insight-and-analysis/long-reads/what-are-health-inequalities.

45. Britton J, Dearden L, Erve Lvd, Waltmann B. The impact of undergraduate degrees on lifetime earnings. Education Df; 29 February 2020. Available from: https://ifs.org.uk/publications/impact-undergraduate-degrees-lifetime-earnings.

Appendix A

Table A.1: Burden of Illness by Country

	England	Scotland	Wales	Northern Ireland
Financial costs	£4,266,459,446	£450,212,586	£284,137,472	£164,554,619
Monetary value of QALYs lost	£11,186,510,202	£1,180,441,946	£744,998,697	£431,456,561
Total QALYs lost	159,807.29	16,863.46	10,642.84	6,163.67
Total life years lost	193,402.45	20,408.54	12,880.21	7,459.41
Burden of Illness	£15,452,969,648	£1,630,654,532	£1,029,136,169	£596,011,180

Abbreviatons: QALY – quality-adjusted life year.

Table A.2: Distribution of Burden of Illness by Country

	England	Scotland	Wales	Northern Ireland
Percentage of UK population	84.61%	8.01%	4.60%	2.78%
Percentage of total Burden of Illness	82.60%	8.72%	5.50%	3.19%

Table A.3: Total Tumour Breakdown by Country

	England	Scotland	Wales	Northern Ireland
Adult malignant	4,650	491	310	179
Adult non-malignant	5,392	569	359	208
Child malignant	261	28	17	10
Child non-malignant	237	25	16	9
Total tumours	10,540	1,112	702	407

Table A.4: Burden of Illness Breakdown by Country

	England	Scotland	Wales	Northern Ireland
Direct healthcare costs	£237,523,560	£25,064,365	£15,818,583	£9,161,132
Household income lost whilst alive	£1,291,872,909	£136,323,209	£86,036,093	£49,826,714
Income lost due to premature death	£2,377,105,119	£250,840,927	£158,310,338	£91,683,428
Welfare system costs	£295,523,346	£31,184,717	£19,681,250	£11,398,147
Additional care costs	£64,434,513	£6,799,368	£4,291,207	£2,485,198
Monetary value of QALYs lost	£11,186,510,202	£1,180,441,946	£744,998,697	£431,456,561
Total	**£15,452,969,648**	**£1,630,654,532**	**£1,029,136,169**	**£596,011,180**

Abbreviations: QALY – quality-adjusted life year.

Table A.5: Burden of Illness Breakdown by Deprivation Group

	IMD Quintile 1	IMD Quintile 2	IMD Quintile 3	IMD Quintile 4	IMD Quintile 5
Direct healthcare costs	£56,682,934	£57,166,216	£58,991,433	£57,846,354	£56,880,704
Household income lost while alive	£308,294,244	£310,922,780	£320,850,000	£314,621,999	£309,369,901
Income lost due to premature death	£567,275,481	£572,112,107	£590,378,646	£578,918,838	£569,254,740
Welfare system costs	£70,524,079	£71,125,371	£73,396,280	£71,971,589	£70,770,142
Additional care costs	£15,376,737	£15,507,840	£16,002,978	£15,692,345	£15,430,387
Monetary value of QALYs lost	£2,669,563,456	£2,692,324,321	£2,778,285,526	£2,724,356,378	£2,678,877,725
Total	**£3,687,716,931**	**£3,719,158,635**	**£3,837,904,863**	**£3,763,407,502**	**£3,700,583,599**

Abbreviations: IMD – Index of Multiple Deprivation; QALY – quality-adjusted life year.

Table A.6: Total Tumour Breakdown by Deprivation Group

	IMD Quintile 1	IMD Quintile 2	IMD Quintile 3	IMD Quintile 4	IMD Quintile 5
Adult malignant	1,110	1,119	1,155	1,132	1,113
Adult non-malignant	1,287	1,298	1,339	1,313	1,291
Child malignant	62	63	65	64	63
Child non-malignant	57	57	59	58	57
Total Tumours	2,515	2,537	2,618	2,567	2,524

Abbreviations: IMD – Index of Multiple Deprivation.

Appendix B

Table B.1: PSA Base Case Results

	Average	Lower 95% CI	Upper 95% CI
Financial costs	£5,147,698,417	£3,605,284,645	£6,834,276,254
Total QALYs lost	187,886.56	149,540.39	228,074.40
Total life years lost	233,198.34	179,530.82	288,730.28
Burden of Illness	£18,299,757,552	£16,539,897,227	£20,036,684,007

Abbreviations: QALY – quality-adjusted life year.

Table B.2: PSA Adults Results

	Average	Lower 95% CI	Upper 95% CI
Financial costs	£4,447,833,479	£2,919,743,304	£6,105,288,198
Total QALYs lost	164,719.36	126,801.52	204,654.99
Total life years lost	204,615.70	151,210.65	260,105.76
Burden of Illness	£15,978,189,016	£14,286,175,185	£17,620,922,293

Abbreviations: QALY – quality-adjusted life year.

Table B.3: PSA Children Results

	Average	Lower 95% CI	Upper 95% CI
Financial Costs	£699,864,938	£501,470,439	£934,411,754
Total QALYs Lost	23,167.19	16,196.18	29,233.93
Total Life Years Lost	28,582.64	22,401.35	34,350.71
Burden of Illness	£2,321,568,536	£1,786,056,377	£2,818,690,150

Abbreviations: QALY – quality-adjusted life year.

Figure B.1: **PSA Convergence Graph**