An economic evaluation of speech and language therapy

Final Report

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Disclaimer

Confidentiality

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List of abbreviations

BI	Barthel Index
CBA	Cost-benefit analysis
DfE	Department for Education
DfES	Department for Education and Skills
GCSE	General Certificate of Secondary Education
KS2/3	Key Stage 2/3
KTEA	Kaufman Test of Education Achievement
NHS	National Health Service
PSSRU	Personal Social Services Research Unit
QALY	Quality Adjusted Life Year
RCSLT	Royal College of Speech and Language Therapists
RCT	Randomised controlled trial
SEN	Special educational needs
SLI	Speech and language impairment
SLT	Speech and language therapy
SLTA	Speech and language therapy assistant
UK	United Kingdom
WAB	Western Aphasia Battery

Contents

1.0 Executive summary

Introduction

It is estimated that nearly 20 per cent of the population may experience communication difficulties at some point in their lives. Communication difficulties are strongly prevalent in children and the elderly and can be related to, for example, head and neck cancer, brain injury, learning difficulties and hearing impairment. 10 per cent of children have a speech and language difficulty and it is the most common disability in childhood. Nearly 30 to 40 per cent of post stroke patients suffer from communication or swallowing complications requiring speech and language therapy.[1]

In the context of increased budgetary pressures, evidence of return on investment is critical to help guide effective spending decisions. To this end, the RCSLT commissioned Matrix Evidence to review the evidence and undertake an economic evaluation of providing SLT to three specific groups – children with SLI, children with autism and stroke survivors – in order to pinpoint the benefits generated by SLT for these cohorts in relation to the costs of provision.

Previous work has demonstrated the value of economic analysis to decision making. Consideration of costs and the value of benefits may produce a different assessment of policies than just considering the effect of a policy. For instance, a policy that was considered effective may not have a positive net benefit.

In summary, the net benefits of SLT – which can be defined in terms of cost savings for health and social care services, improved quality of life, and productivity gains – exceed the costs of its provision.

Aim of the research

The aim of this research was to determine the economic value generated by SLT. Specifically, the costs and benefits of SLT for the following four cohorts and conditions were assessed:

- Adults with experience of dysphagia post-stroke
- Adults with experience of aphasia post-stroke
- Children with speech and language impairment (SLI)
- Children with autism

Results

The results of the analysis indicate that SLT for all four cohorts and conditions represent an efficient use of public resources. The net benefits of the interventions are positive and the benefit-cost ratios are higher than 1. In other words, the benefits generated by the interventions

[1] Royal College of Speech and Language Therapists (2010) *Giving voice*, viewed 23 November 2010.

exceed their costs. Benefits considered in the analysis include health and social care cost savings, quality of life, and productivity gains. The total annual net benefit across three conditions (aphasia, SLI, and autism) is £765 million; dysphagia was excluded from this calculation since the two post-stroke conditions are not mutually exclusive.

It is important to note that the analysis is necessarily based on a subset of the benefits generated by SLT. For instance, the estimate of the benefit of SLT for stroke survivors with communication problems does not include the effect on return to work. As a result, it is possible that the analysis underestimate the benefit generated by SLT. Furthermore, this analysis only includes SLT for four cohorts. Further analysis is required to estimate the value SLT generates across all populations who benefit from it.

Dysphagia (swallowing problems following stroke)

- Every £1 invested in low intensity SLT is estimated to generate £2.3 in health care cost savings through avoided cases of chest infections.
- In comparison to usual care by a non-specialised nurse, speech and language therapy is estimated to prevent 4,300 cases of chest infections requiring hospital care, and 9,200 cases of chest infections requiring community care. This reduction in chest infections results in health cost savings that exceed the cost of the SLT by £13.3 million.
- Dysphagia is a swallowing disorder caused by neurological damage; symptoms include difficulty swallowing food and liquids which can lead to health consequences.
- It is estimated that approximately 63,000 adults per year in the UK suffer post stroke dysphagia requiring SLT.
- Further breakdown of the net benefits shows that the estimated annual net benefit is £11.2m in England, £0.7m in Wales, £0.4m in Northern Ireland, and £1.1m in Scotland.
- The economic analysis is likely to underestimate the benefits of speech and language therapy. The benefits of SLT go beyond reduction in chest infections –e.g. improved quality of life, avoidance of malnutrition, and death. Inclusion of these benefits is likely to increase the net benefit.

Aphasia (communication problems following stroke)

- Every £1 invested in enhanced SLT is estimated to generate £1.3 due to the monetary benefit associated with a quality of life gain.
- In comparison to routine SLT, enhanced SLT results in an estimated 0.057 Quality Adjusted Life Years (QALY) gain per patient. The associated annual benefits are estimated to exceed the cost of the enhanced SLT by £15.4 million.
- Aphasia is a language disorder caused by neurological damage; symptoms include difficulty with one or several forms of communication including speech, comprehension, reading and writing.
- It is estimated that around 53,000 adults per year in the UK suffer post stroke aphasia requiring SLT.
- The benefits of SLT are derived from reduced symptoms of aphasia leading to improved ability to perform daily living activity and health related quality of life gains.

- Further breakdown of the net benefits shows that estimated annual net benefit is £13.0m in England, £0.7m in Wales, £0.4m in Northern Ireland, and £1.3m in Scotland.

Speech and language impairment (SLI)

- Every £1 invested in enhanced SLT generates £6.43 through increased lifetime earnings.
- In comparison to routine SLT, enhanced SLT is estimated to result in an additional 5,500 students achieving 5 or more GCSEs A*-C (or equivalent). The resulting benefit of providing enhanced SLT for all children aged 6 to 10 who currently have SLI exceeds the cost of the SLT by £741.8 million.
- Continued implementation of SLT for those children entering this cohort – children with SLI turning 6 years old – would generate a net benefit of £148.4 million per year in subsequent years.
- SLI is a condition involving disruption in one or several parameters of language: sound system, signalling word endings, grammar, meaning and/or intended meanings.
- It is estimated that approximately 203,000 children 6 to 10 years in the UK have SLI requiring SLT.
- The benefits of SLT are derived from improved communication leading to improved educational achievement and in turn increased adult earnings.
- Further breakdown of the net benefits shows that estimated annual net benefit is £623.4m in England, £36.1m in Wales, £24.2m in Northern Ireland, and £58m in Scotland.

Autism

- Every £1 invested in enhanced SLT generates £1.46 through lifetime cost savings and productivity gains.
- In comparison to routine SLT, an enhanced SLT program targeting parent-child interaction results in improved communication which increases future independence. Increased independence results in a greater number of individuals living in private and supported accommodation in adulthood, relative to residential and hospital settings. The resulting benefit of providing enhanced SLT for children aged 2 to 4 who currently have autism exceed the cost of the SLT by £9.8 million.
- Continued implementation of SLT for those children entering this cohort – children with autism turning 2 years old – would generate a net benefit of £3.3 million per year in subsequent years.
- Autism is a neurodevelopmental condition identified by the presence of behavioural impairments: impaired social interaction, communication and social imagination. The impairments are characterised by abnormalities in reciprocal social interactions and in patterns of communication.
- It is estimated that every year around 8,800 children aged 2 to 4 years in the UK have core autism requiring SLT.
- Further breakdown of the net benefits shows that the estimated annual net benefit is £8.3m in England, £0.4m in Wales, £0.3m in Northern Ireland, and £0.8m in Scotland.

Methods of the research

The research adopted the following stages:

- A review of evidence available to estimate the benefits of SLT interventions within each condition specified above.
- The construction of decision models to perform cost-benefit analysis, a method for comparing the costs and effects of an intervention in monetary terms.
- Consultation with experts and members of the RCSLT throughout the research to validate the evidence found and the economic models constructed.

The models were estimated assuming that the interventions are run once per annum –thus estimated costs are per year. The benefits of the interventions for conditions experienced by adults (i.e. dysphagia and aphasia) occur over one year, whilst the benefits of the interventions for conditions experienced by children (i.e. SLI and autism) span over a much extended period as the models convert short term outcomes into lifetime benefits. In accordance with H.M. Treasury's Green Book, a 3.5 per cent discount rate was applied to calculate the present value of costs and benefits. Unless stated otherwise, all monetary figures are in 2009 prices.

As with any analysis of the costs and benefits of public policy, the results of the analysis are subject to uncertainty. The models constructed to estimate costs and benefits drew on the existing literature. Care was taken to draw on the best available evidence from the literature. Inevitably, however, there remains uncertainty in the estimates generated by the analysis. The results summarised above represent the best estimates that emerge from the analysis. Each of these best estimates was subject to sensitivity analysis to determine the effect of the uncertainty in the existing data on the results of the analysis. The sensitivity analysis provides some comfort that the results of the analysis – that SLT represents a good use of public resources – is unlikely to be impacted by this uncertainty.

Conclusion

The results of the economic analysis suggest that SLT for treating dysphagia, aphasia, SLI and autism generates positive net benefits. Even though the estimated net benefits are subject to uncertainty, the sensitivity analysis suggested that the conclusion that the interventions represent an efficient use of public resources is unlikely to change.

Further, it is important to reiterate that the analysis is necessarily based on a subset of the populations that benefit from SLT and the value generated by SLT. As a result, it is possible that the analysis underestimates the benefit generated by SLT.

2.0 Introduction

Communication is an essential life skill that enables independence, participation and individual responsibility. Research commissioned by the Royal College of Speech and Language Therapists (RCSLT) suggests that overcoming speech and language difficulties can contribute to the generation of a number of important social outcomes, including: independence, health, community participation, educational attainment, employment, and well-being (RCSLT, 2009a).

Despite the evidence for its beneficial outcomes, in the current economic climate the reductions in the size of public sector budgets in the short- and medium-term mean that speech and language therapy (SLT) is at risk of marginalisation and funding cuts. In this context, Matrix Evidence was commissioned by the RCSLT to undertake research into the economic case for SLT.

The value of economic analysis to decision making has been demonstrated elsewhere (Chalfin et al, 2008). For instance, a policy or intervention that generates a positive effect may still not represent an efficient use of resources if it does so at a high cost. It is, thus, important to consider both the cost of an intervention and the value of the effect it generates.

Speech and language interventions may address a variety of problems and adopt multiple types of therapies. A case study approach was therefore adopted, where the analysis focused on the special case of a set of conditions. The conditions were chosen based on the following criteria:

- Services that were perceived to be under threat from the current austerity measures, and for which evaluation of cost-effectiveness and value of money would be most useful.
- Conditions which are less understood in terms of the value of SLT intervention and may be considered as high cost.
- Conditions that fulfilled the criteria above, and where the necessary data was available to carry out the analysis.

Based on the above criteria, the following conditions were selected:

- Adults with experience of dysphagia post-stroke
- Adults with experience of aphasia post-stroke
- Children with speech and language impairment (SLI)
- Children with autism

For each condition, an evaluation of the costs and benefits of a SLT intervention was undertaken. The interventions evaluated compare either: (a) the effects of SLT with the effects of alternative forms of treatment; or (b) the effects of more intensive SLT with the effects of less intensive SLT.

More specifically: the following interventions were evaluated:

- SLT for dysphagia post-stroke patients compared with usual care.
- Enhanced National Health Service (NHS) SLT for aphasia post-stroke patients compared with usual NHS SLT.
- Enhanced SLT for children with SLI compared with existing SLT provision.
- Enhanced SLT for children with autism compared with usual SLT treatment.

Costs and benefits are presented for different geographical areas, including: (a) the United Kingdom (UK); (b) the four constituent countries (England, Wales, Scotland and Northern Ireland); and (c) local areas within each of the countries. In consultation with key stakeholders, the following local areas were selected for each country: strategic health authorities for England (10), unitary local authorities for Wales (22), local authorities for Scotland (32), local commissioning boards for Northern Ireland (5),

The effects of the interventions were expressed in monetary terms and compared against the cost of delivery to obtain a measure of the net benefits derived from the interventions. Depending on the nature of the outcomes achieved, the effects of the interventions were expressed in monetary terms by estimating the resulting health and social care cost savings or quality of life gains.

This report presents the methodology and findings of the research. The report is structured as follows. The next section presents the overall methodological approach used. Each of the interventions is then addressed in a separate section providing: a description of the intervention for each condition, the nature of the expected benefits generated by the interventions, and the findings from the economic analysis. Section 8 discusses the implications of the findings.

3.0 Methodological approach

3.1 Conceptual model

Each of the four SLT interventions was assessed using a cost-benefit analysis (CBA). A CBA compares the costs and effects of an intervention, all expressed in monetary terms. Therefore, a CBA is built upon the following three elements:

- The ***effects*** of the intervention, expressed in natural units (e.g. number of cases).
- The ***costs*** associated with the intervention.
- The ***benefits*** of the intervention –i.e. the monetary value of the effects generated by the intervention.

Following best practice, decision models were built to assess the costs and benefits of the interventions. Building these models required understanding the interventions, the targeted populations, and the nature of the expected benefits – i.e. the effect of the interventions and the logic of how these generate benefits. The structures of the decision models built for each intervention are presented in Appendix 2.

The following costs and benefits were included in the models:

- Direct costs: running cost of delivering the interventions.
- Benefits: these vary depending on the nature of the intervention but generally refer to health and social care cost savings and quality of life gains.

3.2 Data collection

Given the multiplicity of effects and benefits considered, data used to populate the models was collected from a wide range of sources. The following sources were used:

- Effect data was obtained from a literature review for each condition provided by the RCSLT and through consultation with SLT experts. The literature reviews are part of a range of tools produced by the RCSLT to support leaders with the planning, commissioning and delivery of services in line with government and local priorities.[2] Based on the literature identified, the best available evidence was selected for modelling each intervention. The criteria for selecting the best available effectiveness studies included:
    - methodological quality: randomised controlled trial (RCT) studies were preferred to less rigorous methods;
    - country of study: where available UK studies were preferred;
    - year of publication: where possible recent studies were selected.

[2] For further details visit: http://www.rcslt.org/speech_and_language_therapy/commissioning/resource_manual_for_commissioning_and_planning_services

The selection of the effect studies was validated by key stakeholders through a workshop ran by Matrix. The studies used in the analysis are outlined in Table 1.

Table 1. Effectiveness study selected for each condition

Condition	Study	Intervention	Counterfactual
Dysphagia	Carnaby et al (2006)	Low intensity SLT: 0.80 hours per week for one month	Usual care by clinical staff: 0.30 hours per week for one month
Aphasia	Bakheit et al (2007)	Enhanced NHS SLT: 1.6 hours per week for 12 weeks	Usual NHS SLT: 0.57 hours per week for 12 weeks
SLI	Boyle et al (2007)	Enhanced SLT: 3 sessions per week for 15 weeks (mean number of attended session 38)	Existing provision: 8 sessions (mean) of SLT in 15 weeks
Autism	Green et al (2010)	Enhanced SLT: 2 hours of parent and child sessions per 2 weeks for 6 months 2 hours of booster sessions per month for 6 months 9.8 hours (mean) of SLT treatment as usual in one year	Treatment as usual: 9.5 hours (mean) of SLT in one year

A more detailed summary of the main characteristics of each study is presented in Appendix 1.

- Cost estimates were calculated based on data on: the resources required for delivering the interventions, as specified in the effectiveness studies, and unit cost data produced by the Personal Social Services Research Unit (PSSRU). Salary bands correspond to the level of the professionals delivering the interventions, as per current practice.
- Benefit estimates were calculated by translating the effect data from the above studies into monetary benefits using literature provided by SLT experts and identified through Google Scholar searches. Details on the sources of data used and the calculations made are provided in the data tables for each intervention, included in Appendix 2.

3.3 Models and presentation of results

The models were run for all potential beneficiaries –that is, the population experiencing the conditions– in England, Wales, Scotland, and Northern Ireland. All monetary figures are in 2009 prices. Where the benefits of the interventions extend over more than one year, in accordance with Green Book guidance, a 3.5 per cent discount rate was applied to calculate the present value of the benefits.

Inevitably, the parameters required to populate the models are subject to uncertainty. The models were put through a series of iterations to examine the effect of variations in key parameters on the results.

The next four sections are devoted to each of the interventions. They provide the following information:

- Key messages from the CBA.
- A description of the intervention in terms of targeted population and services provided.
- The nature of the expected benefits – i.e. the effect of the interventions and the logic of how these generate benefits.
- The findings from the economic analysis, including:
  - findings;
  - sensitivity analysis; and
  - assumptions.

Key messages are presented using two indicators that synthesise the results of the CBAs:

- The ***net benefit***, which is calculated as the total benefits attributed to the intervention minus the total costs of implementing the interventions to all potential beneficiaries. The net benefit value shows the overall magnitude of the interventions. Values higher than zero indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources. The net benefit is an aggregate measure and, as such, its magnitude changes with the size of the population receiving the intervention. For each intervention, an aggregate figure for the UK population is presented. Figures for each of the four countries and by local area are included in Appendix 3.
- The ***benefit-cost ratio***, which is calculated as the ratio of benefits to costs. The benefit-cost ratios show the potential return for every £1 investment. Values higher than one indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources. The benefit-cost ratio is a unit measure and does not change with the size of the population receiving the intervention.

The net benefit at the local level is estimated by applying the unit cost and benefits of the intervention to the populations eligible to receive the intervention at different geographical levels. The estimates, therefore, assume that types of care and prevalence rates are constant across different areas. The estimate of population eligible is based on local level population estimates broken down by age. Thus the demographic differences across areas are taken into account. The country level benefits are estimated by aggregating the local level figures.

4.0 Dysphagia post-stroke

Key messages

In the UK the annual benefits generated by SLT compared to usual NHS care for post acute stroke dysphagia (swallowing problems) patients exceed the annual cost of the therapy by £13.3 million.

Every £1 invested in SLT generates £2.3 in health care cost savings through avoided cases of chest infection.

These estimates refer to SLT delivered to around 63,000 people experiencing the condition post stroke and in need of treatment in England, Wales, Scotland and Northern Ireland.

The potential benefits of SLT are underestimated. The benefits of SLT are multiple in nature and go beyond avoidance of chest infections. Additional benefits may include improved quality of life, more specifically the ability to return to normal diet, functional swallowing, and avoidance of malnutrition, and death. The implications of this limited scope are that the benefits are likely to be underestimated and therefore the net benefits generated by the interventions could be greater.

The intervention

Dysphagia is a swallowing disorder caused by neurological damage affecting many patients post-stroke. Patients suffering from dysphagia have difficulty swallowing food and liquids, which can result in serious consequences –e.g. choking, malnutrition, aspiration pneumonia and death.

For patients who do not recover from dysphagia spontaneously, speech and language therapists provide them with tailored patient specific therapy. SLT involves assessment and diagnosis of dysphagia, teaching the patient how to manage the condition, and working with other clinical staff to achieve optimal levels of nutrition and hydration. The importance of SLT has been recognised in national and international practice guidelines (RCSLT, 2009a).

The CBA focused on SLT for *treatment* (as opposed to diagnosis) of dysphagia in post-stroke patients. The aim of the CBA was to estimate the cost and benefit of dysphagia treatment delivered by a speech and language therapist compared to alternative treatment. The relative benefit of treatment delivered by a speech and language therapist was estimated based on evidence provided by Carnaby et al (2006).

Carnaby et al (2006) analysed a sample of 306 patients in Australia admitted to a hospital for stroke within the previous seven days and diagnosed with dysphagia using the Paramatta Hospital assessment of dysphagia. Patients were randomly assigned to routine care, low intensity SLT, and high intensity SLT. Routine care was defined as management of dysphagia by clinical (non-specialised) staff as per usual practice for one month. At the workshop held by Matrix to validate selected studies, experts recognised SLT practice in Australia as a relatively valid comparator in a UK setting. Although SLT assistants in Australia and UK are different in terms of their qualifications, it is assumed that the effect size they generate in patients' outcomes is the same. For the purpose of the decision model clinical (non-specialised) staff was assumed to be an NHS day ward nurse. Low intensity SLT involved "swallowing compensation strategies, mainly environmental modifications, safe swallowing advice, and appropriate dietary modification" with a SLT three times a week for one month. High intensity SLT was the same as low intensity, but every day for one month.

The effect of the alternative forms of treatment was measured in terms of dysphagic-related complications –specifically chest infections. High intensity SLT had no statistically significant effect over and above low intensity SLT. Therefore low intensity SLT was selected for the purpose of the decision model. Carnaby et al (2006) estimated that the probability of developing a chest infection with SLT is 25 percent, compared to 47 per cent with routine care. That is, treatment delivered by a speech and language therapist, compared to routine care, reduces likelihood of a chest infection by 22 percentage points. It is estimated that the cost per patient of SLT is £219, compared to a cost £58 in routine care (calculations are available in Table A2.1 in Appendix 2).

A reduction in the number of chest infections leads to health care and community care cost savings associated with the treatment of the infection. A chest infection requires hospital treatment in 32 per cent of cases and community care is required in the remaining 68 per cent of cases (Guest and Morris, 1997). It is estimated that a chest infection requiring hospital treatment costs £5,084, while a chest infection requiring community care costs £150. Hospital treatment is significantly higher due to increased in-patient days (Matrix based on Guest and Morris, 1997).

Summary of findings

Table 2 summarises the findings from the CBA of SLT in approximately 63,000 dysphagia post-stroke patients in need of treatment across England, Wales, Scotland and Northern Ireland. Annual costs and monetary benefits in both scenarios, routine care and SLT, are presented separately. The differences represent the incremental costs and monetary benefits attributable to SLT.

Table 2. Annual costs and benefits of SLT for dysphagia patients in England, Wales, Scotland and Northern Ireland (£m in 2009 prices)

£ in 2009 prices	Routine care	SLT	Difference
Costs			
Cost of SLT	£0m	£13.8m	-£13.8m
Cost of routine care	£3.7m	£0m	£3.7m
Total			-£10.1m
Monetary benefits			
Cost of chest infection requiring hospital admission	£48.2m	£26.1m	£22.1m
Cost of chest infection requiring community care	£3.0m	£1.6m	£1.4m
Total			£23.5m
Net benefit			£**13.3m**
Benefit-cost ratio			**2.32**

Throughput

- Incidence of stroke is 0.26 per cent across all age groups (Carroll et al, 2001).
- 78 per cent of stroke patients suffer from some form of dysphagia (RCSLT, 2009a).
- 51 per cent of patients suffering from dysphagia require SLT (Mann et al, 1999).
- Therefore, the incidence of dysphagia requiring treatment is 0.10 per cent.
- Local level population estimates from England[3], Wales[4], Scotland[5], and Northern Ireland[6] were aggregated resulting in a total population of 61 million. Applying the incidence of dysphagia to the total population, the estimated population suffering from dysphagia post-stroke is over 63,000.
- It is estimated that SLT results in approximately 4,300 avoided cases of chest infection requiring hospital care and 9,200 avoided cases of chest infection requiring community care.

Costs

- It is estimated that the cost per patient of SLT is £219. The total amount of SLT was 7.8 sessions; each session was 24.8 minutes, which is equivalent to 3.22 hours. (Carnaby et al, 2006). A cost of £67 per hour client contact with a hospital speech and language therapist Band 7 was used to arrive at this estimate (Matrix based on PSSRU, 2009).
- It is estimated that the cost per patient of routine care is £58. The total amount of time with NHS staff was 4.8 sessions; each session was 16 minutes, which is equivalent to

3 NHS Information Centre (2008) Attribution Dataset GP Registered Populations.
4 Ibid.
5 Office for National Statistics (2001) Area and population by local authority (Scotland): Regional Trends 37.
6 Department of Health Social Services and Public Safety (2009)

1.28 hours. (Carnaby et al, 2006). A cost of £45 per hour client contact with a NHS hospital day ward nurse was used to arrive at this estimate (Matrix based on PSSRU, 2009).
- The incremental cost of SLT compared to routine care for all patients with dysphagia post-stroke is estimated to be £10.1 million.

Monetary benefits

- A chest infection requiring hospital treatment costs £5,084 (Guest and Morris, 1997).
- A chest infection requiring community care costs £150 (Guest and Morris, 1997).
- It is estimated that health and community care cost savings generated by SLT due to reduced cases of chest infection amount to £23.5 million.

Country level analysis

Table 3 presents the result for the CBA of SLT for dysphagia post-stroke patients in need of treatment disaggregated by country.

Table 3. Annual cost and annual benefits of SLT for dysphagia post-stroke patients disaggregated by country (£m in 2009 prices)

Country	Dysphagia patients	Total cost	Total benefit	Total net benefit
England	52,700	£8.5m	£19.7m	£11.2m
Wales	3,100	£0.5m	£1.1m	£0.7m
Scotland	5,300	£0.9m	£2.0m	£1.1 m
Northern Ireland	1,800	£0.3m	£0.7m	£0.4m
Total	62,900	£10.1m	£23.5m	£13.3m

The results from the local level analysis indicate that:

- Annual net benefits in England range from £561k in the North East strategic health authority to £1.7m in London.
- Annual net benefits in Wales range from £12k in the Merthyr Tydfil unitary health authority to £71k in Cardiff.
- Annual net benefits in Scotland range from £4k in the Orkney Islands local authority to £128k in Glasgow City.
- Annual net benefits in Northern Ireland range from £65k in the Western local commissioning board to £99k in the Northern commissioning board.

More detail on local level analysis can be found in Table A3.1 in Appendix 3.

Sensitivity analysis

A few parameters used in the model are subject to varying degrees of uncertainty. Therefore, additional analysis was undertaken to observe the sensitivity of the net benefit to a change in the model parameters. The sensitivity analysis suggests that the results of the model are robust –i.e. the conclusion that investing in SLT represents an efficient use of public resources does not change.

Table 4 summarises the parameters that were tested along with the ranges used for the sensitivity analysis. Figures 1 and 2 show the impact on net benefit.

Table 4. Sensitivity analysis

Parameter	Value in model	Sensitivity analysis range	
		Low	High
Probability of chest infection with SLT	25%	25%	40%
Cost of chest infection requiring hospital admission	£5,084	£1,800	£5,100

Figure 1 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the probability of developing a chest infection with SLT is below 38 per cent, compared with a probability of 47 per cent following routine care.

Figure 1. Sensitivity of net benefit to probability of chest infection for patients with dysphagia receiving SLT

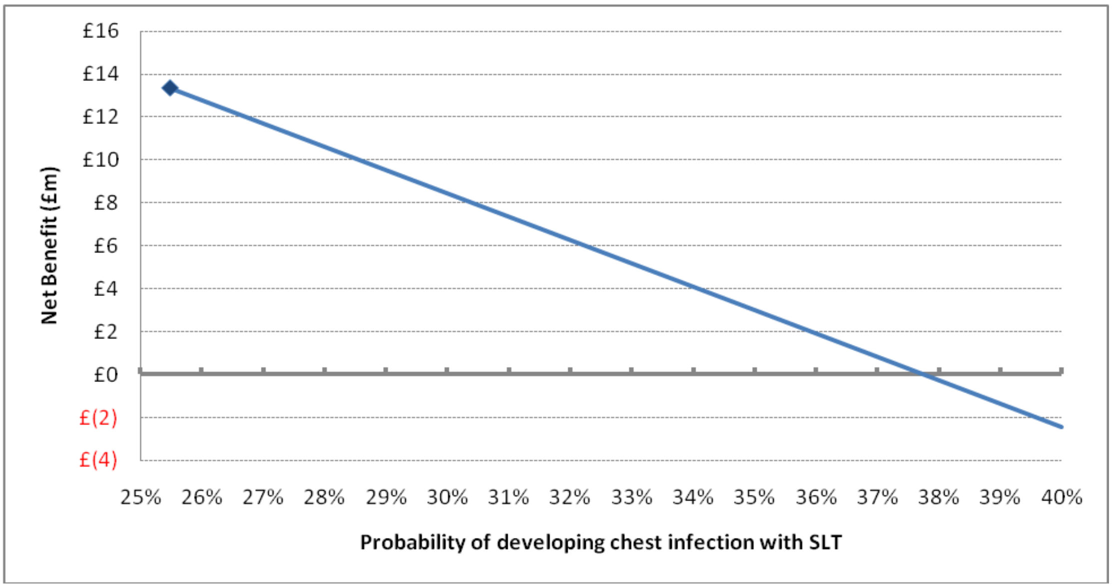
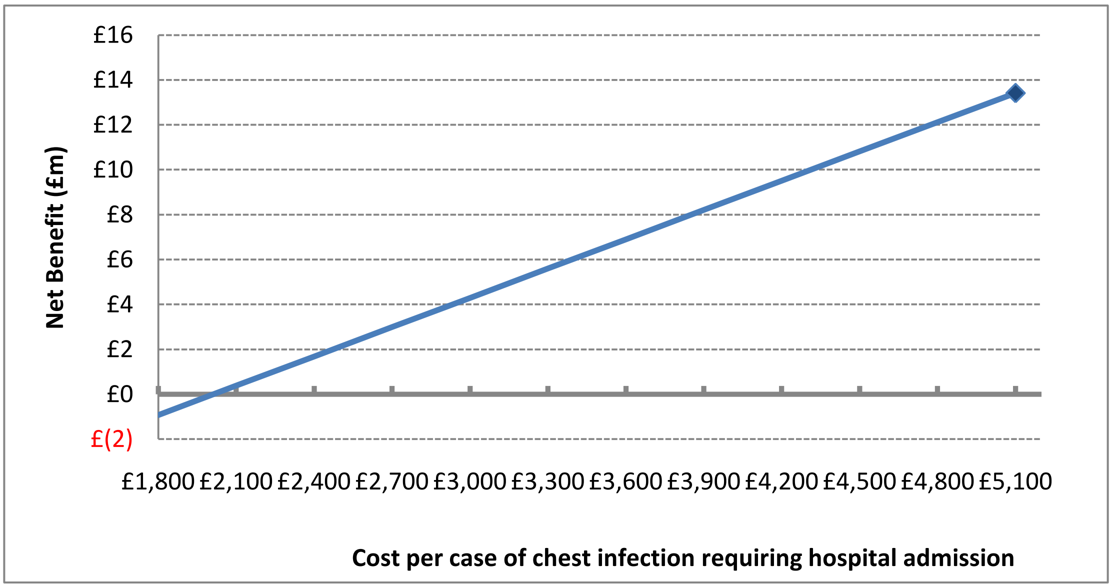


Figure 2 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the major health care cost avoided by the intervention –i.e. the cost per chest infection requiring hospital admission– is above £2,000. This figure is considerably below the value used in the model (£5,084 per patient).

Figure 2. Sensitivity of net benefit to cost per case of chest infection requiring hospital admission



Key assumptions

- The effect of SLT was measured in terms of avoided cases of chest infection due to dysphagia. The term chest infection can be used to describe a number of different conditions. To calculate the health care costs associated with a chest infection it was assumed that a chest infection due to dysphagia is similar in treatment to community acquired pneumonia.
- The probability that a chest infection requires either hospital or community care was based on descriptive data not specific to dysphagia patients. It was assumed that for patients with a chest infection due to dysphagia the same probabilities of requiring either hospital or community care as for the general population apply.
- Treatment costs associated with community acquired pneumonia were obtained from Guest and Morris (1997). After consultation with a medical expert it was assumed that the management of community acquired pneumonia has not changed since 1997 and that cost data could be used after being adjusted to 2009 prices.
- It was assumed that routine care was provided by a nurse in a day ward. If a more specialised nurse provided care the unit cost would be higher, and the incremental cost of the intervention would be lower. In that scenario, the net benefit would be higher –i.e. these figures potentially underestimate the net benefit.
- The benefit is evaluated for an average of 48 minutes of SLT per week over 4 weeks. Dysphagia SLT treatment often occupies more time than this; the intervention evaluated

here represents the lower end of the range. This implies that both the cost and benefit of the intervention may be underestimated.

5.0 Aphasia post stroke

Key messages

In the UK the annual benefits generated by an extra hour of SLT per week for 12 weeks for post acute stroke aphasia (communication problems) patients exceed the annual cost of the therapy by £15.4 million.

Every £1 invested in SLT generates £1.3 –the equivalent in monetary terms to the benefit generated in terms of quality adjusted life years.

These estimates refer to SLT delivered to over 53,000 people experiencing the condition post stroke in England, Wales, Scotland and Northern Ireland.

These results should be treated with caution given uncertainty in the estimated benefits. Improved communication certainly has benefits in terms of quality of life – e.g. improved communication, reduced stress, and less dependence on others. However, quantifying this benefit required several assumptions to be made. Sensitivity analysis indicates that the conclusion of the analysis –that the intervention is cost-effective and an efficient use of resource– is not impacted by this uncertainty.

The intervention

Aphasia is a language disorder caused by neurological damage affecting almost one third of patients post-stroke. The severity of the condition is dependent on the location and size of the area of the brain damaged. Patients suffering from aphasia can have difficulty with one or several forms of communication including speech, comprehension, reading and writing.

Speech and language therapists provide persons with aphasia with tailored patient specific therapy. SLT attempts to help patients better manage the condition by: teaching strategies that are accessing language, strengthening remaining language abilities, restoring lost abilities, teaching other methods of communication, and teaching others (e.g. family, health staff) ways to improve communication with the patient (RCSLT, 2009b).

The CBA focused on SLT for treatment of aphasia in post acute stroke patients. The aim of the CBA was to estimate the cost and benefit of SLT compared with no SLT. Due to limited evidence, the CBA estimates the cost and benefit of *enhanced* NHS SLT compared to *usual* NHS SLT. The relative benefit of additional treatment delivered by a speech and language therapist was estimated based on evidence provided by Bakheit et al (2007).

Bakheit et al (2007) analysed a sample of 116 patients in England admitted to a hospital for first ever stroke and diagnosed with aphasia using the Frenchay Aphasia Screening test and the

Western Aphasia Battery (WAB) test. The WAB is an instrument used to diagnose the severity of aphasia by testing language function through sub tests in areas such as fluency, comprehension, reading, and writing. Scores on each subset are weighted to calculate an Aphasia Quotient which ranges between 0 and 100 (Wertz et al, 1984). Patients were randomly assigned to usual NHS SLT, enhanced NHS SLT, and intensive NHS SLT. Usual NHS SLT care was defined as management of aphasia by a NHS SLT as per usual practice for 2 hours a week for 12 weeks. In practice, however, usual NHS SLT was 0.57 hours of SLT per week. Enhanced NHS SLT was defined as SLT for 2 hours a week for 12 weeks. In practice enhanced NHS SLT was 1.6 hours of SLT per week. Intensive NHS SLT was defined as five hours a week for 12 weeks. In practice intensive NHS SLT was 3 hours per week.

The effect of increased amount of treatment was measured in terms of improved performance in the WAB test. Intensive NHS SLT had no significant effect over and above enhanced NHS SLT. Therefore enhanced NHS SLT was selected for the purpose of the decision model. Bakheit et al (2007) estimated that in patients receiving usual NHS SLT the WAB test score improved by 43 per cent while in patients receiving enhanced NHS SLT the WAB test score improved by 79 per cent. That is, enhanced NHS SLT, compared to usual NHS SLT, increases performance in WAB test by 36 percentage points. It is estimated that the cost per patient of enhanced NHS SLT is £1,313 while the cost per patient of usual NHS SLT therapy is £469 (calculations are available in Table A2.2 in Appendix 2).

Higher performance on the WAB test has implications in terms of quality of life and independence. For the purpose of estimating the benefit of enhanced NHS SLT compared to usual NHS SLT, improvement in the WAB test was translated into increased Quality Adjusted Life Years (QALY)[7]. A number of steps were required to convert the improvement in the WAB test into a QALY gain. First, the mean WAB score in Bakheit (2007) was converted into a different aphasia scale, developed by Wade et al (1985). This conversion relied on the assumption that both scales have a similar distribution. Second, based on data provided by Wade et al (1985), a correlation between the aphasia scale and the Barthel Index (BI) was derived. The BI is a tool used to measure the ability of patients to perform daily living activity. Third, a paper by Exel et al (2004) was used to determine the relationship between the BI and QALY values. In sum, the QALY gain was obtained by converting aphasia scores into ability to perform daily living, and then into QALY values. More details on the steps applied can be found in Table A2.2 in Appendix 2.

The QALY gain was expressed in monetary terms by using the value associated with a QALY – £20,000. This corresponds to the lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Health and Clinical Excellence (NICE) and commonly used in economic evaluations valuing health outcomes.

[7] A QALY is a standardised measure of health gain widely used in health economics. It comprises two dimensions: time and quality of life. The latter is measured on a scale between 0 (death) and 1 (perfect health). For instance, 1 year if perfect health is measured as 1 QALY. The advantage of this scale is twofold: not only does it allow different health effects to be expressed on a single scale; but there are also accepted monetary values for QALYs that allow these effects to be expressed in monetary values (£).

Summary of findings

Table 5 summarises the findings from the CBA of SLT for about 53,000 aphasia patients across England, Wales, Scotland and Northern Ireland. Annual costs and monetary benefits in both scenarios, usual NHS SLT and enhanced NHS SLT, are presented separately. The differences represent the incremental costs and monetary benefits attributable to SLT.

Table 5. Annual costs and benefits of SLT for aphasia post-stroke patients (£m in 2009 prices)

£ in 2009 prices	Usual NHS SLT	Enhanced NHS SLT	Difference
Costs			
Cost of enhanced NHS SLT	£0m	£69.2m	-£69.2m
Cost of usual NHS SLT	£24.8m	£0m	£24.8m
Total			-£44.5m
Monetary benefits			
QALY gain in £'s	£126.6m	£186.5m	£59.9m
Total			£59.9m
Net benefit			£**15.4m**
Benefit-cost ratio			**1.35**

Throughput

- Incidence of stroke is 0.26 per cent across all age groups (Carroll et al, 2001).
- One third of stroke patients suffer from some form of aphasia (RCSLT, 2009b). Therefore, the incidence of aphasia is 0.09 per cent.
- Local level population estimates from England[8], Wales[9], Scotland[10], and Northern Ireland[11] were aggregated resulting in a total population of 61 million. Applying the incidence of aphasia to the total population, the estimated population suffering from aphasia post-stroke is about 53,000.

Costs

- It is estimated that the cost per patient of enhanced NHS SLT is £1,313. The total amount of SLT was 19.3 hours over 12 weeks. (Bakheit et al, 2007). A cost of £67 per hour client contact with a community speech and language therapist Band 7 was used to arrive at this estimate (Matrix based on PSSRU, 2009).

8 NHS Information Centre (2008) Attribution Dataset GP Registered Populations.

9 Ibid.

10 Office for National Statistics (2001) Area and population by local authority (Scotland): Regional Trends 37.

11 Department of Health Social Services and Public Safety (2009)

- It is estimated that the cost per patient of usual NHS SLT is £469. The total amount of SLT was 6.9 hours over 12 weeks. (Bakheit et al, 2007). A cost of £67 per hour client contact with a community speech and language therapist Band 7 was used to calculate this estimate (Matrix based on PSSRU, 2009).
- The incremental cost of enhanced NHS SLT compared to usual NHS SLT for all patients with aphasia post-stroke is estimated to be £44.5 million.

Monetary benefits

- Enhanced NHS SLT results in an incremental QALY gain per patient of 0.057.
- It is estimated that the value of the QALY gain generated by enhanced NHS SLT compared to usual NHS SLT associated with improved communication in post-stroke aphasia patients amounts to £59.9 million.

Country level analysis

Table 6 presents the result for the CBA of SLT for aphasia post-stroke patients disaggregated by country.

Table 6. Annual cost and annual benefits of SLT for aphasia post-stroke patients disaggregated by country (£m in 2009 prices)

Country	Dysphagia patients	Total cost	Total benefit	Total net benefit
England	44,200	£37.2m	£50.2m	£13.0m
Wales	2,600	£2.2m	£2.9m	£0.7m
Scotland	4,400	£3.7m	£5.0m	£1.3m
Northern Ireland	1,500	£1.3m	£1.7m	£0.4m
Total	53,000	£44.4m	£59.8m	£15.4m

The results from the local level analysis indicate that:

- Annual net benefits in England range from £650k in the North East strategic health authority to £1.9m in London.
- Annual net benefits in Wales range from £14k in the Merthyr Tydfil unitary health authority to £82k in Cardiff.
- Annual net benefits in Scotland range from £5k in the Orkney Islands local authority to £146k in Glasgow City.
- Annual net benefits in Northern Ireland range from £75k in the Western local commissioning board to £114k in the Northern commissioning board.

More detail on local level analysis can be found in Table A3.2 in Appendix 3.

Sensitivity analysis

A few parameters used in the model are subject to varying degrees of uncertainty. In particular, additional analysis was undertaken to observe the sensitivity of the net benefit to a change in the percentage improvement in the WAB test following standard SLT and a change in the incremental QALY gain. The sensitivity analysis suggests that the results of the model are robust –i.e. the conclusion that investing in SLT represents an efficient use of public resources does not change.

Table 7 summarises the parameters that were tested along with the ranges used for the sensitivity analysis. Figures 3 and 4 show the impact on the net benefit.

Table 7. Sensitivity analysis

Parameter	Value in model	Sensitivity analysis range	
		Low	High
Incremental QALY gain	0.057	0.040	0.058
Percentage improvement in WAB test following standard SLT	79%	70%	80%

Figure 3 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the percentage improvement in the WAB test following enhanced NHS SLT is above 72 per cent, compared to 79 per cent used in the model. The percentage improvement following usual NHS SLT was 43 per cent; therefore, the net benefit remains positive as long as those under enhanced NHS SLT perform 29 percentage points above the usual NHS SLT group.

Figure 4 demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the incremental QALY gain is above 0.042, compared with a value of 0.057 used in the model.

Figure 3. Sensitivity of net benefit to percentage improvement in WAB test in patients with aphasia post-stroke receiving standard SLT

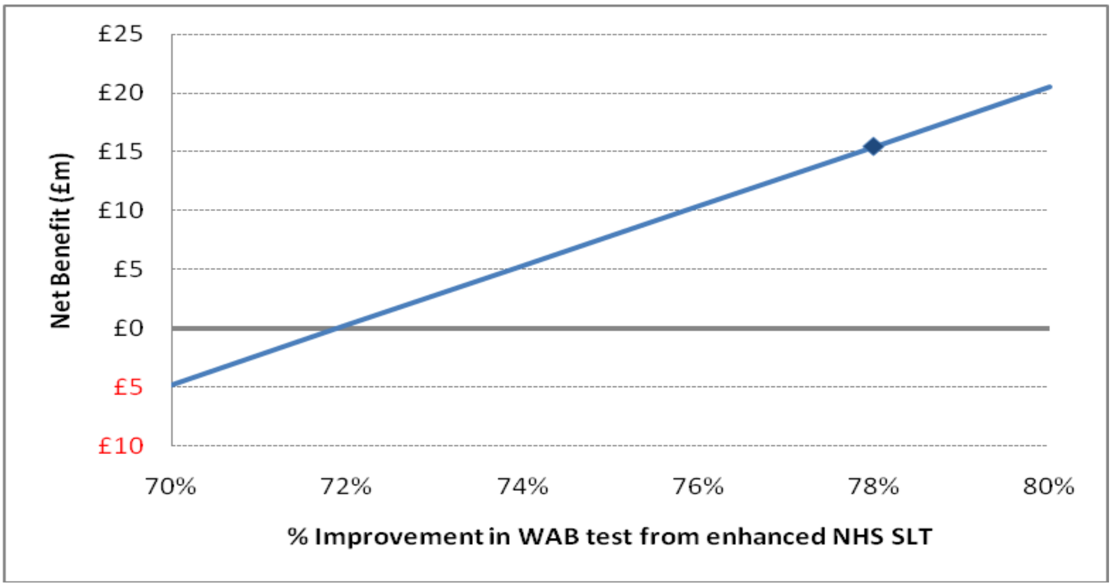
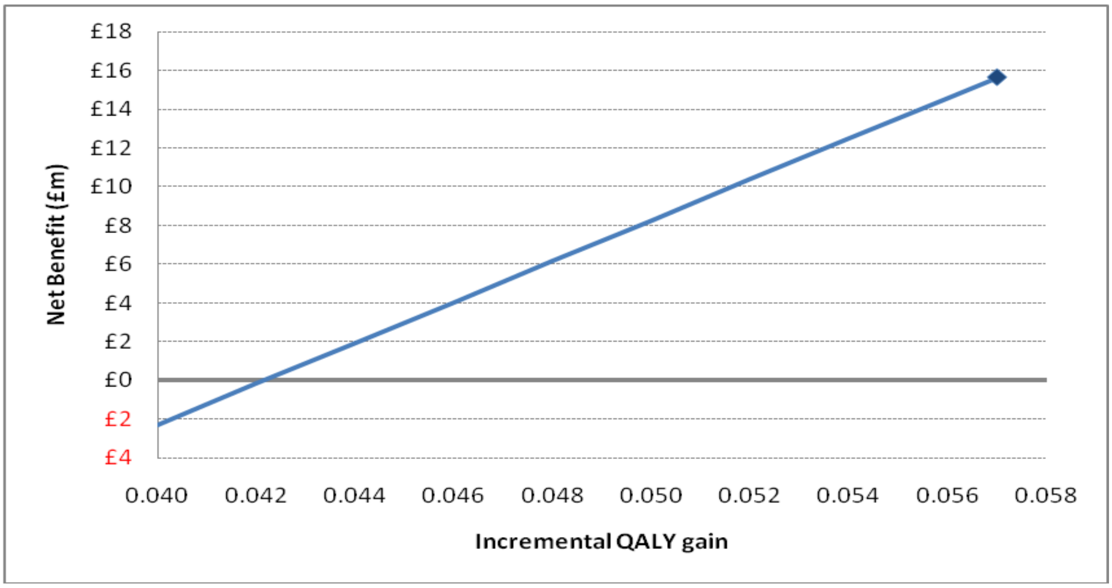


Figure 4. Sensitivity of net benefit to QALY gain in patients with aphasia post-stroke receiving SLT



Key assumptions

- A number of steps were required to translate the improvement in the WAB test into a QALY gain. These steps required the assumptions outlined below. More details can be found in Table A2.2 in Appendix 2.
- The aphasia test used in Wade et al (1985) was different from the aphasia test used to measure the effect of the intervention –i.e. the WAB test. However, both exams have similar methods of measuring language impairment; therefore it was assumed both tests are comparable and that they have a similar distribution.
- The aphasia test in Wade et al (1985) is rated on a scale of 0-20. The paper states that a score of 14 and below is associated with a BI score of 8.6, and a score of 15 and above is associated with a BI score of 12.8. Using this data, a linear relationship was assumed between the aphasia test and the BI.
- Exel et al (2004) provide data on bands of BI scores and equivalent QALY values. Based on this data, a linear relationship was assumed between BI and QALYs.
- Our research has not examined the costs and benefits of longer term speech and language therapy or interventions at a later stage, which may both add to the costs and benefits. It also does not include the wider benefits of aphasia, such as return to employment after stroke in working age individuals.

6.0 Children with speech and language impairment

Key messages

In the UK the benefits in terms of increased lifetime earnings generated by around 15 additional hours of SLT over a period of 15 weeks for children 6 to 10 years with speech and language impairment exceed the cost of the therapy by £741.8 million.

Every £1 invested in the SLT intervention generates £6.4 in lifetime earnings.

These estimates refer to SLT delivered to over 203,000 children experiencing the condition in England, Wales, Scotland and Northern Ireland.

These results should be treated with caution given uncertainty in the estimated benefits. Improved communication skills have multiple benefits for individuals with SLI, including increased access to curriculum. However, the nature of the existing evidence base means that any quantification of this benefit is subject to uncertainty. Sensitivity analysis indicates that it is likely that the conclusion of the analysis – that the intervention is cost-effective and an efficient use of resource – is not impacted by this uncertainty. It is also important to note that the analysis covers only the benefits generated by education. It does not capture additional benefits such as improved quality of life, social inclusion or mental health gains.

The intervention

Speech and language impairment (SLI) is a varied condition affecting as many as 15 per cent of children, depending on the exact definition of the condition and the age group considered. A median prevalence estimate is 5.9 per cent from birth to 7 years (Law et al, 1998). The condition involves a disruption in one or several parameters of language: sound system, signalling word endings, grammar, meaning and/or intended meanings. Depending on the area of language affected, an individual can be classified as having a speech or a language impairment, or both. SLI can present as a delay or a disorder, the former being characterised by development that is behind but following normal developmental pattern, and the latter by a pattern of development that differs from the norm. In practise the two conditions can be difficult to distinguish, particularly in early childhood. The condition is also often present with secondary conditions such as autistic, cognitive or learning impairments. SLI can impact the life of the individual in many ways. The restricted ability to understand and be understood in the communicative environment can cause concern and upset, behavioural problems, and impact the individual's ability to access education and employment (if needs continue into adulthood), and prevent them from fully participating in society (RCSLT, 2009c).

Speech and language therapy for SLI aims to prevent the development of the condition and to work on developing language skills appropriate to the age of the individual (RCSLT, 2009c).

The SLT package is tailored to the specific needs of the patient and the areas of speech or language that require most support. For children of school age, the package aims to support access to curriculum and provide advice on social interaction in different settings in and out of school. The intervention can be delivered by a qualified speech and language therapist (direct intervention) or by those most in contact with the individual (indirect intervention), and can be provided individually or to a group of individuals with similar needs.

The CBA focused on the treatment of SLI for primary school aged children. While speech and language difficulties are more common in younger children, the spontaneous remission rate of around 50-60 per cent makes it more problematic to reliably analyse cost-effectiveness of speech and language therapy (Boyle et al 2007). If speech and language difficulties persist to the age of 5 years, then it is highly probable that, if not treated, problems continue through school, having long term consequences on the educational experience of the individual. The focus of the CBA is therefore on a group with potentially more severe impairment than if the analysis was carried out using a younger population. This can have an overestimating effect on the net benefit. The intervention evaluated in the CBA is based on evidence provided by Boyle et al (2007) on treatment of language impairment. This introduces uncertainty into the analysis, as the impact of enhanced SLT on children with a primary speech impairment may be different.

Boyle et al (2007) undertook an RCT of provision of SLT for children aged 6 to 11 years with primary language impairment. The trial examined direct/indirect versus individual/group therapy modes together with a control group which received existing levels of community based SLT. The intervention consisted of 45 SLT sessions of 30 minutes, scheduled three times per week for 15 weeks. Due to compliance rate of less than 100 per cent, the mean number of sessions attended was 38. For the control group, the mean number of contacts was 8. Due to the nature of SLT, the content of the sessions varied by participant. However, the intervention received was based on a therapy manual produced at the beginning of the study. Therefore, while the exact activities children engaged with varied across individuals and groups, they were all consistent with a unified approach. The main outcome measure was standardised scores on tests of expressive and receptive language.

The study found no significant difference between the direct and indirect modes of therapy and between the individual and group modes. There was however evidence of a significant difference in the post-intervention expressive language scores between groups receiving therapy and the control group, suggesting a benefit in the increase in provision of therapy. The effect size chosen for the CBA was for direct therapy relative to control group, in order to capture more accurately the effect of a qualified speech and language therapist. The indirect therapy modes were also less desirable for the model as the assistants used in the trial were all psychology graduates. This is not representative of typical practise and the effect of the therapy might be overestimated if the background of the assistants makes them more qualified for the role. To cost the intervention, it was assumed that the therapists were Band 7. This introduces a potential inconsistency, as the speech and language therapists used in the RCT are described as Band 2. Because of the harmonisation of the banding introduced in 2004 by the Agenda for Change reform, it is not clear how the banding referred to in Boyle et al (2007), using a pre-2004 scale, translates to current bands. After discussions with the RCSLT, it was concluded that Band 2 corresponds to both current Band 6 and the lower end of Band 7. Evaluating costs using Band 7 therefore potentially overestimates the cost of the intervention and thus underestimates its net benefit. As the effect size is for direct therapy (i.e. all therapists were qualified), the cost of the intervention is not adjusted for the use of assistants.

Improved language facilitates access to curriculum and creates opportunity for greater academic attainment. Descriptive data on pupil progress (DFES, 2003) suggests that students who perform at a higher level at Key Stage 2 (KS2) assessments at 11 years tend to perform better at Key Stage 3 (KS3) at the age of 14. Good performance at KS3 tends to be associated with a better average performance at the General Certificate of Secondary Education (GCSE) exams, which in turn is associated with higher expected earnings (Cummings et al, 2007). Therefore one of the long run benefits of SLT is the increased lifetime earning potential for the individual. Academic attainment was chosen as the outcome variable for the CBA.

The initial level of KS2 attainment (baseline) was estimated based on Beitchman et al (1996). The authors examined the academic outcomes at 12.5 years for children identified at 5 years as speech and/or language impaired, compared to a control group. The authors found that children who perform poorly in a battery of speech and language tests also score worse on the Kauffman Test of Educational Achievement (including measures of spelling, reading and maths) than children in the control group, whose scores fall within the normal range in the speech and language tests. The relative performance of the two groups was used to calculate the baseline KS2 attainment for SLI children, compared to the general population average. DfE (former DCSF) has published statistics on the proportion of students with speech, language and communication difficulty achieving level 2 or less and level 4 or more at KS2. This source was not used for the baseline, as it was not detailed enough to use on its own. However, the data was used to indicatively validate the estimates used in the model. The baseline probability of students achieving level 3 or less used in the model is 56 per cent, compared to the actual of 51 per cent (DCSF, 2007). Therefore it is possible that the academic achievement of children with SLI at KS2 is underestimated.

The effect of the intervention is applied to the baseline by assuming all students experience an improvement in their scores equivalent to the improvement in expressive language. As a consequence students close to threshold marks will reach the level above their level at baseline, resulting in a change in the distribution of students at KS2. The benefit of the intervention is represented by the increase from the baseline in the probability of achieving higher grades at KS2. Assuming that the effect of the intervention in terms of expressive language leads to a proportional increase in scores is likely to overestimate the net benefit. This assumption is tested using sensitivity analysis.

It is assumed that performance at KS3 and GCSEs is solely dependent on performance at the previous Key Stage. The improved KS2 performance therefore translates into improved grades through to GCSEs. It is likely that children with SLI encounter challenges throughout academic life. To capture these challenges, the progression statistics from KS2 through to GCSE level used are for the special educational needs (SEN) population.[12] This potentially underestimates the academic attainment of SLI children, as the SEN figures include a wide range of conditions, beyond SLI, which can have a dramatic effect on educational achievement, e.g. serious behavioural problems. The lifetime benefit of the intervention is defined as the present value of the incremental lifetime earnings for an individual with 5 GCSE A*-C (or equivalent) compared with 5 GCSE A*-G.

The progression of students from KS2 to GCSEs is based on descriptive data. Therefore it does not suggest causality, but simply that students who perform at a high level at early stages of education are likely to show similar achievement through academic life. This can be caused by a variety of factors other than high scores at the previous educational level, and should hence be treated with caution. This is particularly the case as the intervention takes place in the primary school years, with a considerable delay before the outcome considered is realised. Again, to validate the estimates of the model, the distribution of GCSE outcomes in the control group was compared against actual educational achievement by students with speech, language and communication difficulty. The percentages are 21 and 23 per cent respectively, suggesting the benefit might be in fact underestimated in the model.

Summary of findings

Table 8 summarises the findings from the CBA of SLT for approximately 203,000 children with SLI across England, Wales, Scotland and Northern Ireland. Annual costs and monetary benefits in both scenarios, usual care and enhanced SLT treatment (as described by the intervention), are presented separately. The differences represent the incremental costs and monetary benefits attributable to SLT.

Table 8. Annual costs and benefits of SLT for children with SLI (£m in 2009 prices)

£ in 2009 prices	Usual SLT	Enhanced SLT	Difference
Costs			
Incremental cost of enhanced SLT provision	£0.0m	£136.6m	-£136.6m
Monetary benefits			
Gain in lifetime earnings, 5+ GCSEs A*-C	£6,907.0m	£7,785.4m	£878.4m
Net benefit			**£741.8m**
Benefit-cost ratio			**6.43**

Throughput

- The prevalence of SLI is 5.9 per cent (Law et al, 1998).
- In 2009, the UK population aged 6 to 10 years was around 3.4 million. With a prevalence rate of 5.9 per cent, this implies approximately 203,000 children with SLI. In

[12] Includes students with and without SEN statement (i.e. on School Action or School Action Plus). Not all children with SLI will be identified as having SEN, but the statistics are taken to represent their potential academic progression.

the academic year 2008/09 there were around 22,000 primary schools in the UK (DCSF, 2009a). This means that the intervention would therefore be delivered to on average 9 pupils per school.

- As a consequence of increased provision of SLT, around 5,500 more children achieve 5 or more GCSEs grades A*-C compared to usual SLT care.

Costs

- The cost difference between direct therapy (individual or group) and usual SLT treatment is £674 per child. This is based on a mean number of sessions of 38 and 8 for children receiving treatment and control, respectively (Boyle et al, 2007). The hourly cost of a Band 7 speech and language therapist is £67.50 (Matrix based on PSSRU, 2009).
- Providing treatment for approximately 203,000 children generates in total £136.6 million in therapy costs.

Monetary benefits

- The present value of the estimated gain in lifetime earnings for individuals with 5 or more GCSEs A*-C compared to over 5 or more GCSEs A*-G is around £160,000 per student (Cummings et al, 2007).
- The present value of the total gain in lifetime earnings generated by the intervention is around £878 million.

Local level analysis

Table 9 presents the result for the CBA of SLT for children with SLI disaggregated by country.

Table 9. Annual cost and annual benefits of SLT for children with SLI disaggregated by country (£m in 2009 prices)

Country	SLI patients	Total cost	Total benefit	Total net benefit
England	170,327	£114.8m	£738.2m	£623.4m
Wales	9,874	£6.7m	£42.8m	£36.1m
Scotland	15,845	£10.7m	£68.7m	£58.0m
Northern Ireland	6,617	£4.5m	£28.7m	£24.2m
Total	202,663	£136.6m	£878.4m	£741.8m

The results from the local level analysis indicate that:

- Annual net benefits in England range from £29.7 million in the North East strategic health authority to £92.1 million in London.

- Annual net benefits in Wales range from £665,000 in the Merthyr Tydfil unitary health authority to £3.8 million in Cardiff.
- Annual net benefits in Scotland range from £222,000 in the Orkney Islands local authority to £6.1 million in Glasgow City.
- Annual net benefits in Northern Ireland range from £4.2 million in the Belfast local commissioning board to £6.1 million in the Northern commissioning board.

More detail on local level analysis can be found in Table A3.3 in Appendix 3.

Sensitivity analysis

The results of the CBA are necessarily subject to uncertainty. Additional analysis is therefore undertaken to observe the sensitivity of the net benefit to a change in the model parameters. The sensitivity analysis suggests that the results of the model –i.e. the conclusion that investing in SLT represents an efficient use of public resources– are unlikely to change as a result of this uncertainty.

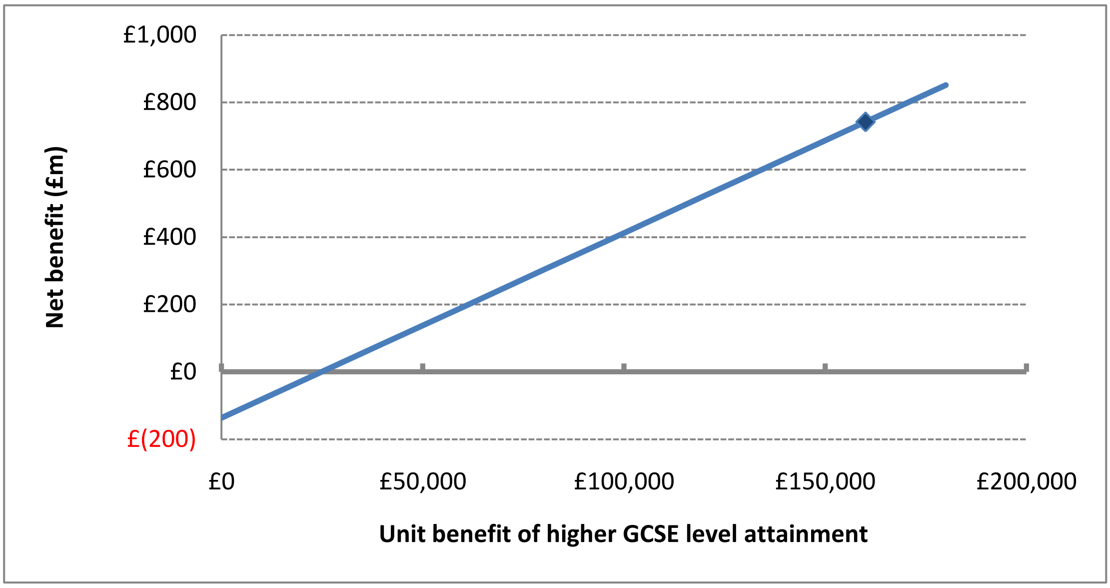
Table 10 summarises the parameters that were tested along with the ranges used for the sensitivity analysis. Figures 5 to 7 show the impact on the net benefit.

Table 10. Sensitivity analysis

Parameter	Value in model	Sensitivity analysis range	
		Low	High
Unit benefit of higher GCSE level attainment	£160,053	£0	£180,000
Improvement in academic performance as a consequence of the intervention	5.2%	0%	6%

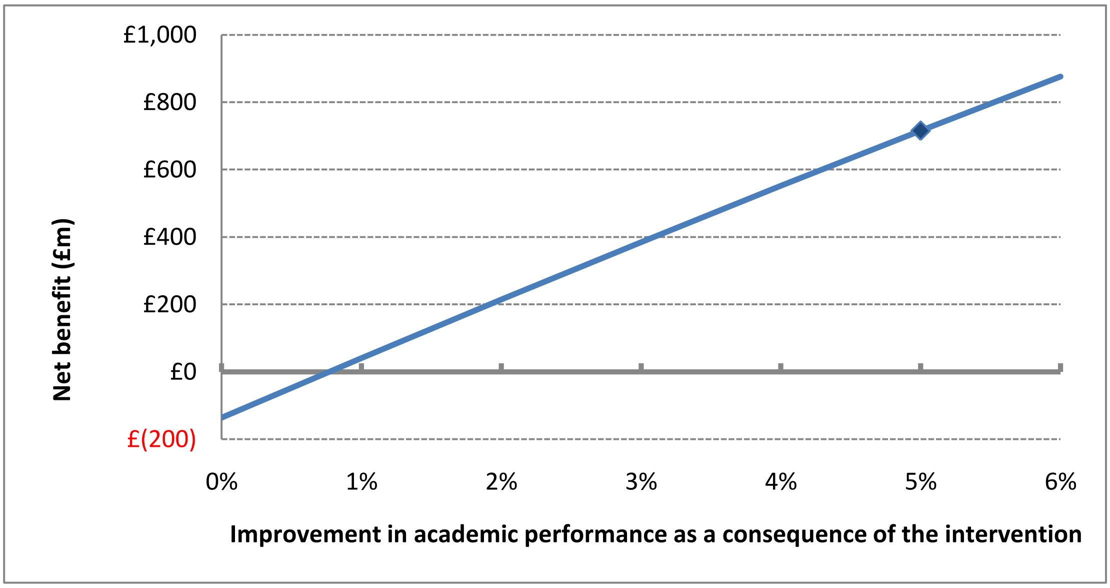
The benefit of the intervention is derived from increased lifetime earnings for individuals with higher GCSE grades. The value used in the model is based on estimations by Cummings et al (2007), using the standard approach used by DfE (former DfES) to obtain the economic value of an academic qualification. It is assumed that SLI in childhood does not impact on earnings in the future in its own right, but that future earning potential is only dependent on academic success. This can lead to an overestimation of the benefits for the population considered, as individuals with a history of SLI might face additional challenges not accounted for by the model. The unit benefit is therefore varied to see the effect on the net benefit of the intervention. Figure 5 demonstrates that the net benefit generated by increased earnings is positive as long as the incremental lifetime earnings for individuals with 5 or more GCSEs of A*-C compared to individuals with 5 or more GCSEs of A*-G are around £40,000. This is about 19 per cent of the value used in the CBA.

Figure 5. Sensitivity of net benefit to the value of the unit benefit of better GCSE results



The net benefit also depends on the impact of the intervention on the academic performance of students with SLI. It is assumed that the improvement in expressive language observed in effect studies is translated into an equal improvement in academic performance. This can be an overestimate of the benefit, as improvement in language might only partially transfer into improved grades. This is particularly the case as the effect of the intervention is on expressive language with limited evidence of improvement in receptive scores. The effect size of the intervention on academic performance is therefore varied to examine the impact on the net benefit. The results in Figure 6 show that the net benefit is positive as long as the effect of the intervention is over 1 per cent, compared to 5 per cent used in the model. This means that as long as one fifth of the effect of the intervention on expressive language is translated into an effect in academic success, the net benefit is positive.

Figure 6: Sensitivity of net benefit to the improvement in academic performance as a consequence of the intervention



Key assumptions

- Evidence from Boyle et al (2007) is for SLT undertaken in a community setting in Scotland. An assumption was made that existing resource use of SLT is similar in other parts of the UK.
- The incremental unit cost of the intervention assumes the intervention is delivered by a qualified speech and language therapist. This is a conservative assumption, potentially overestimating the cost of the SLT, as it is likely that the intervention would be at least partly delivered by speech and language therapy assistants, with lower unit cost. Boyle et al (2007) found no significant difference in the effect of the intervention relating to the status of the person delivering it. In the RCT the assistants were however all psychology graduates, which is not typical. For this reason the effect of the indirect therapy modes is also more uncertain, supporting the choice of direct therapy in the selection of cost and effect.
- The cost of SLT was estimated using the harmonised Band 7 wage. The intervention was delivered by Band 2 therapists, but because of inconsistencies in banding at the time, it is not entirely translatable to the harmonised bands.
- The SLI prevalence rate used in the CBA is the median prevalence from birth to 7 years found by a review by Law et al (1998). While the prevalence for older children is likely to be lower, the range of estimates in the literature is 1-15 per cent, depending on the criteria used to identifying SLI. Therefore 5.9 per cent is taken as a conservative estimate. It is also important to note that while the prevalence rate changes the size of the net benefit, the benefit-cost ratio of 6.43 is unaffected due to a proportional reduction in costs.

- It is assumed that the effect of enhanced SLT is the same for children with speech impairment as it is for children with language impairment. This may overestimate the net benefit as students with speech impairment are likely to be less distinguishable from general population once they start to read.
- The model does not include spontaneous recovery. This is because of the age group considered. Evidence suggests that children whose pre-school language problems are not resolved by school entry have ongoing and significant problems in both written and spoken language through compulsory education (Boyle et al, 2007).
- It is assumed that improvement in expressive language results in a proportional improvement in academic achievement. This is likely to overestimate the benefit, but the sensitivity analysis shows that the net benefit remains positive even when the impact of the intervention is reduced.
- Benefits gained during the intervention are assumed to be maintained until KS2 assessment, i.e. the academic performance of the children does not regress when the intervention is over. This may overestimate the benefit.
- The progression probabilities used in the model are for the SEN population. This implies the assumption that SLI patients face more challenges than the general population throughout school, regardless of their previous achievement. This might underestimate the benefit, as the SEN statistics include individuals with conditions with serious impacts on educational achievement, such as behavioural problems.
- It is assumed that performance at KS3 and GSCEs are solely dependent on performance at the previous Key Stage, i.e. children with SLI are as likely to achieve a KS3 level given KS2 performance as SEN children. This means that any additional educational challenge caused by childhood SLI is not captured by the model.

7.0 Children with autism

Key messages

In the UK the lifetime benefits generated by 36 additional hours of SLT to increase parental synchronisation for children 2 to 4 years with autism exceeds the cost of the therapy by £9.8 million. The benefits are derived from reduced service use and productivity gains for the family as a consequence of improved communication and independence.

Every £1 invested in the SLT intervention generates £1.5 in lifetime cost savings.

These estimates refer to SLT delivered to around 8,800 children experiencing the core condition in England, Wales, Scotland and Northern Ireland.

These results should be treated with caution given uncertainty in the data available to estimate benefits. Improved communication skills have multiple benefits for individuals with autism, including increased independence. However, quantifying this benefit required several assumptions to be made. Sensitivity analysis gives some comfort that the conclusion of the analysis – that the intervention is cost-effective and an efficient use of resource – is unlikely to be impacted by this uncertainty. It is also important to note that the analysis covers only a part of the benefits. For example the effects of improved communication on mental health, education and employability of the individual are not included.

The intervention

The term Autistic Spectrum Disorder (ASD) is generally used to cover the conditions Autism, Atypical Autism and Asperger's Syndrome. The disorder is a neurodevelopmental condition identified by the presence of behavioural impairments: impaired social interaction, communication and social imagination. The impairments are characterised by abnormalities in reciprocal social interactions and in patterns of communication. The individual's interests and activities are also restricted, stereotyped and of repetitive repertoire. Defining ASD is generally problematic, as autism is a continuum with individuals having a range of abilities and characteristics. The separation of the three identified groups is difficult, and conditions in the autistic spectrum are therefore usually not treated as discrete conditions. (RCSLT, 2009d) The heterogeneity of the condition also results in difficulty in estimating the prevalence rate. The Autism Society estimates that 1 in 100 children in the UK are affected by the condition. Around 40 per cent of them have the core condition (Green et al, 2010).

The consequences of autism are varied, and highly dependent on the cognitive and intellectual abilities of the individual with ASD. As many as a third of individuals with the condition do not develop useful language, and those who do face difficulties in social communication. For example, the inability of autistic individuals to interpret subtle emotional concepts (such as empathy) and understand unspoken rules of interaction can lead to misunderstandings and upset for both the individual and those around him. Also heightened sensitivity to sounds, textures, foods and lights affect the ability of the individual to cope in certain environments. This can cause serious barriers to participation in society, and prevent access to education and employment, in addition to forming meaningful relationships. Individuals generally require support through life, and have limited independence.

Most patients are diagnosed by 3-4 years of age, apart from some high level functioning forms of the condition which can remain undetected for longer. Autism is a lifelong condition, and the work of SLT focuses management of the condition rather than prevention. The therapy provided depends on the age, ability and specific areas of difficulty for the patient, but generally focuses on developing communication, social interaction and life skills. In addition to language, SLT also aims to provide skills and strategies for coping with change and understanding appropriate behaviour. The therapist will most often work in a multidisciplinary and multi-agency team. (RCSLT, 2009d)

Early intervention has been advocated to treat delays in language development for autistic children, improving the probability of developing useful language. The CBA therefore focuses on children between 2 and 4 years (inclusive) and is based on a RCT study by Green et al (2010). The intervention described focused on increasing parental sensitivity and responsiveness to child communication. In addition, it aimed to further aid the child's communication development through a promotion of a range of strategies such as action routines. The families attended a 2-hour clinic session every other week for 6 months, followed by monthly booster sessions for 6 months. In total the families received 36 hours of therapy, delivered in addition to the treatment as usual provided by their local SLT services. A control group received usual SLT care only. On average, the control group received 9.8 hours of SLT over the course of the study.

The primary outcome was the ADOS-G social communication algorithm scale, which is a measurement of the severity of the symptoms of autism. There were also three secondary outcomes.

1. ***Parent-child interaction during naturalistic play*****,** measured by proportion of parental communications with the child that were synchronous, child initiations as a proportion of communication with the parent and proportion of time spent in mutual shared attention.
2. ***Child language and social communication*****,** measured by the researcher using pre-school language scales. Also reported by parent using the McArthur Communicative Development Inventory, and the Communication and Symbolic Behaviour Scales Developmental Profile social composite raw scores.
3. ***Adaptive functioning in school beyond the family***, using the Vineland Adaptive Behaviour Scales, Teacher rating form.

The study found no significant decrease in autistic symptoms as a consequence of the intervention, and the effects on directly observed language and adaptive functioning in school were small. However, there was a significant positive effect on parent-child interaction, particularly parental synchronisation. This is not surprising as it is an outcome targeted by the intervention.

The ability to coordinate interest in external objects or events with other people supports the child in reaching important language milestones. It is characteristic of autistic children to have a deficit in joint attention, and they also develop language late and at slower rates than the general population. The literature suggests that responsive parental behaviours reliably predict children's rate of language acquisition, even in the autistic population. Siller and Sigman (2008) find a positive and significant relationship between a measure of maternal synchronisation and rate of change in language age in a sample of autistic children. This relationship is used in the CBA to translate the impact of the intervention described in Green et al (2010) into an improved level of language in childhood.

Improved communication skills can have a wide range of positive consequences on the lives of autistic individuals and their families. Communication reduces stress within the family and facilitates the management of the condition through life. Howlin et al (2004) find in a study of 68 individuals with ASD that verbal ability in childhood (expressed as verbal IQ over or below 30) is significantly associated with a more independent residential status, more demanding level of work and a better overall social outcome in adulthood. In the CBA, the estimated level of language as a consequence of the intervention was transformed into an increased probability of reaching the threshold verbal IQ score of 30 compared to usual SLT care.

The outcome considered in the CBA was residential status, which is assumed to be a proxy for the level of independence achieved by the individual. Improved autonomy is a key aim of the treatment of autism, and an important determinant of quality of life for most individuals with the condition (Rosenblatt, 2008). The categories considered are private accommodation (either own or with family), supported accommodation (i.e. residential accommodation with some autonomy), residential accommodation (with little or no autonomy) and hospital accommodation. The valuation of the benefit is based on Knapp et al (2009), which measures cost of service use and productivity associated with each of the above accommodation categories, taking into account intellectual disability and residential status. The decision was made to use the estimates for individuals with intellectual disability to capture the greater expense of managing core condition relative to individuals with a higher level functioning condition. The estimate does not include productivity loss for the individual, but does take into account the lost productivity for the family members caring for the autistic individual.

Employment outcomes were not included in the CBA. Howlin et al (2004) have analysed the relationship between verbal IQ and the level of work. However the population considered in the study is different than the core autistic population considered in the CBA, and discussion with the National Autistic Society suggested that in the case of employment the two groups were too different for this data to be used in a reliable way. Residential status was therefore preferred, particularly as the severity of the condition could be factored in when using the segmentation by Knapp et al (2009) by intellectual disability. Uncertainty remains over how applicable the level of independence results of Howlin et al (2004) are in the core autistic population. Therefore sensitivity analysis was carried out to test the impact of this assumption. It is also important to bear in mind that autism is a developmental condition and the level of independence of the individual in adulthood is influenced by a range of factors. Caution is therefore required in the interpretation of the results.

Summary of findings

Table 11 summarises the findings from the CBA of SLT for around 8,800 children with autism across England, Wales, Scotland and Northern Ireland. Annual costs and monetary benefits in both scenarios, usual SLT care and enhanced SLT treatment (as described by the intervention), are presented separately. The differences represent the incremental costs and monetary benefits attributable to SLT.

Table 11. Annual costs and benefits of SLT for children with autism (£m in 2009 prices)

£ in 2009 prices	Usual SLT	Enhanced SLT	Difference
Costs			
Incremental cost of enhanced SLT provision	£0.0	£21.3m	-£21.3m
Monetary benefits			
Cost of supported accommodation	£1,689.4m	£1,693.0m	-£3.6m
Cost of residential accommodation	£1,215.9m	£1,208.7m	£7.2m
Cost of hospital accommodation	£1,337.7m	£1,310.3m	£27.5m
Total	£4,243.0m	£4,211.9m	£31.1m
Net benefit			**£9.8m**
Benefit-cost ratio			**1.46**

Throughput

- The prevalence of core autism is 0.4 per cent. (Green et al, 2010)
- Aggregated from country level data, there are around 2.2 million children aged 2 to 4 in the UK.
- This implies around 8,800 core autistic children aged 2 to 4.

Costs

- The unit cost of the intervention is £2,430. This includes 36 hours of SLT for a year, at the cost of £67.50 per hour (Matrix based on PSSRU, 2009)
- Providing the intervention for around 8,800 children generates a cost of £21.3 million.

Monetary benefits

- The annual incremental cost of an individual with autism in supported accommodation over private accommodation is around £51,400. The present value of the lifetime cost is around £876,000 per individual (Matrix based on Knapp et al, 2009)
- As a consequence of the intervention, 4 more people annually achieve the level of independence required to be able to live in supported accommodation. This generates a lifetime cost of £3.6 million.
- The annual incremental cost of an individual with autism in residential accommodation compared to private accommodation is around £52,400. The present value of the lifetime cost is around £893,000 per individual (Matrix based on Knapp et al, 2009).
- As a consequence of the intervention, 8 less people annually are accommodated in residential accommodation. This generates a lifetime cost saving of £7.2 million.
- The annual incremental cost of an individual with autism in hospital accommodation compared to private accommodation is around £61,300. The present value of the lifetime cost is around £1.0 million per individual.
- As a consequence of the intervention, 26 less people annually are accommodated in hospital settings. This generates a lifetime cost saving of £27.5 million.

Local level analysis

Table 12 presents the result for the CBA of SLT for children with autism disaggregated by country.

Table 12. Annual cost and annual benefits of SLT for children with autism disaggregated by country (£m in 2009 prices)

Country	Autistic patients	Total cost	Total benefit	Total net benefit
England	7,376	£17.9m	£26.2m	£8.3m
Wales	399	£1.0m	£1.4m	£0.4m
Scotland	697	£1.7m	£2.5m	£0.8m
Northern Ireland	291	£0.7m	£1.0m	£0.3m
Total	8,763	£21.3m	£31.1m	£9.8m

The results from the local level analysis indicate that:

- Annual net benefits in England range from around £384,000 in the North East strategic health authority to £1.4 million in London.
- Annual net benefits in Wales range from around £9,000 in the Merthyr Tydfil unitary health authority to around £52,000 in Cardiff.
- Annual net benefits in Scotland range from around £3,000 in the Orkney Islands local authority to around £83,000 in Glasgow City.

- Annual net benefits in Northern Ireland range from £56,000 in the Belfast local commissioning board to around £83,000 in the Northern commissioning board.

More detail on local level analysis can be found in Table A3.4 in Appendix 3.

Sensitivity analysis

The results of the CBA are necessarily subject to uncertainty. Additional analysis is therefore undertaken to observe the sensitivity of the net benefit to a change in the model parameters. The sensitivity analysis gives some comfort that the results of the model–i.e. the conclusion that investing in SLT represents an efficient use of public resources – are unlikely to change as a result of this uncertainty.

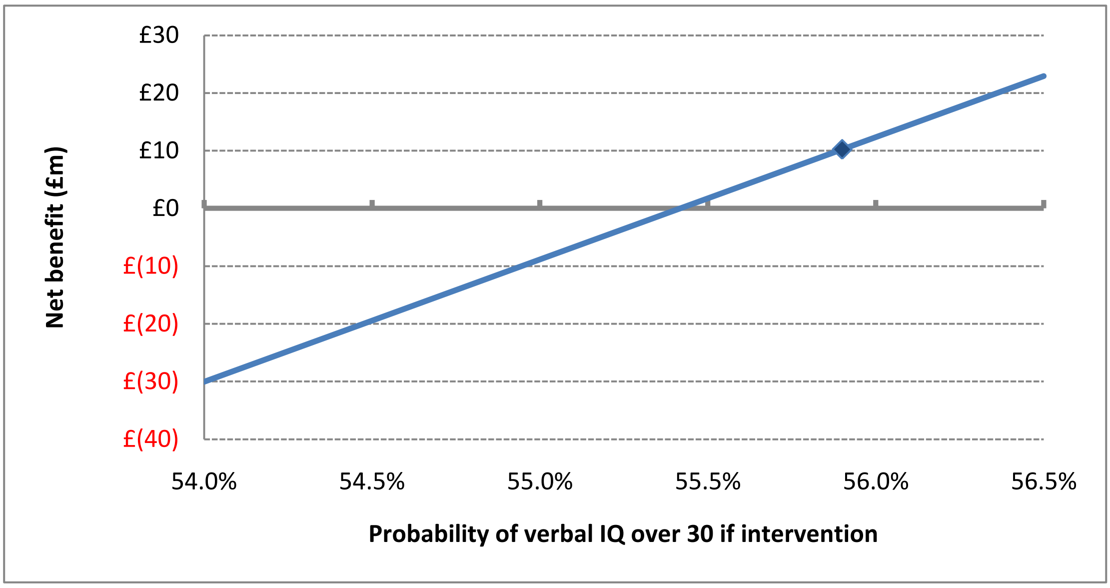
Table 12 summarises the parameters which were tested along with the ranges used for the sensitivity analysis. Figures 8 and 9 show the impact on net benefit.

Table 12. Sensitivity analysis

Parameter	Value in model	Sensitivity analysis range	
		Low	High
Probability of verbal IQ over 30 if intervention	55.9%	54.0%	56.5%
Probability of private accommodation if verbal IQ over 30	58.6%	35.0%	60.0%

The net benefit is dependent on the relationship between the increased parental synchronisation and gains in language. The effect size is 1.5, resulting in an increase in the probability of developing a verbal IQ of over 30 from 54 to 55.9 per cent. The exact relationship is complex and difficult to evaluate. Hence the estimate used in the model is varied between 54 per cent (the probability of developing verbal IQ of over 30 before the intervention, i.e. no effect) and 56.5 per cent to observe the impact on net benefit. The results below show that as long as the probability of verbal IQ over 30 is above 55.4 per cent after intervention, the net benefit is positive. That is, the effect size used in the model, 1.5, would have to reduce by 26 per cent for the benefits of the intervention not to exceed the costs.

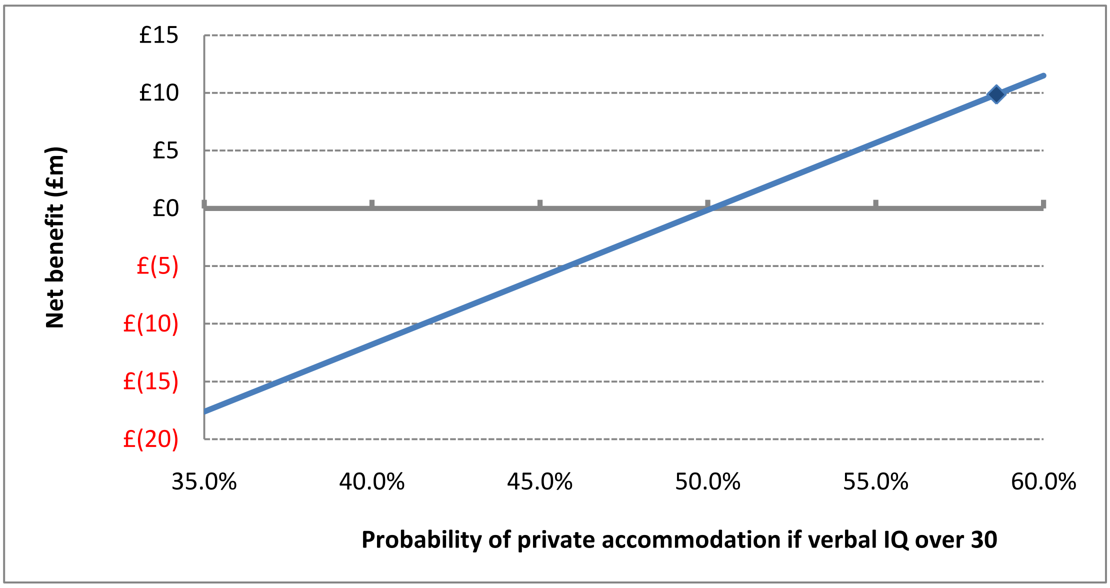
Figure 8. Sensitivity of net benefit to the probability of verbal IQ over 30 if receive intervention



The net benefit also depends on the increased independence of the individual as a consequence of improved verbal IQ. The probability of different accommodation outcomes is based on a follow-up study by Howlin et al (2004), and costed using Knapp et al (2009). Both papers look at general autistic population, and do not focus on individuals with the core condition like Green et al (2010). In the CBA model, overall 48 per cent of the individuals receiving the intervention end up in private accommodation. For individuals with verbal IQ over 30 the probability is 59 per cent compared to 35 per cent for individuals with verbal IQ less than 30. The assumption made by Knapp et al (2009) is that 35 per cent of individuals with ASD with intellectual disability live in private accommodation, compared to 79 per cent of those with no intellectual disability. Therefore there is a possibility that the net benefit is overestimated in the CBA.

Knapp et al (2009) estimate costs separately for individuals with and without intellectual disability. To capture the more limited capabilities of individuals with the core condition, the costs for intellectual disability are used in this analysis. As similar differentiation is not provided in Howlin et al (2004), sensitivity analysis is undertaken to ensure that the results are not a consequence of overestimated levels of independence. Keeping the relative shares of non-private accommodation options constant, the probability of living in private accommodation given verbal IQ of over 30 is varied to observe the effect on net benefit. The results in Figure 9 show that the net benefit is positive as long as the probability of living in private accommodation is over 50 per cent for individuals with a verbal IQ of over 30, compared to 59 per cent used in the model. This is equivalent to a 38 per cent decrease in the effect of verbal IQ on living in private accommodation.

Figure 9: Sensitivity of net benefit to the impact of verbal IQ on the probability of living in private accommodation in adulthood



Key assumptions

- The intervention effect is applied to the synchronisation between the parent and the child. The increased synchronisation is then translated into greater language gains over a period of around 44 months, i.e. 3 years and 8 months. The intervention effect is hence assumed to be sustained over this period, i.e. the synchronisation level once achieved is maintained.
- The analysis does not incorporate any possible benefits associated with continued and ongoing SLT treatment. Individuals with autism are likely to receive tailored support from therapists throughout their life.
- The distribution of verbal IQ is assumed to be the same for the core autistic population as for the general autistic population. This may result in an overestimate of the proportion of population with a verbal IQ of over 30. The exact distribution determines whether the net benefit is overestimated or underestimated. If the proportion of individuals with a verbal IQ of less than 30 is greater for the core autistic population than the ASD population, but a sufficient proportion of individuals are close enough to the threshold, the net benefit may be underestimated. This is because receiving the intervention will result in a greater number of people achieving the threshold, and a larger number of people will experience the benefit. .
- The probability of adulthood outcomes is estimated using the mean and standard deviation provided in Howlin et al (2004) and assuming a normal distribution. This is unlikely to hold in the autistic population and the true distribution is unknown. It is likely that the distribution is skewed to the right, and the probability of more independent outcomes overestimated.

- The relationship between level of independence in adulthood and verbal IQ at 7 years is similar for all individuals with ASD. I.e. given an individual with ASD has a verbal IQ of over 30, his likelihood of living in private accommodation is not impacted by whether he has the core condition or not. This is likely to overestimate the benefit as a person with a more severe condition is likely to be restricted in independence because of a wide range of factors. The sensitivity analysis on this assumption shows that the net benefit is positive even if this assumption is relaxed.
- The model assumes that living in private accommodation is associated with greater independence and preferred by the autistic individual and his family. This assumption is based on the rating system used in Howlin et al (2004) which uses “independence” and “residential status” interchangeably, and evidence in the literature that independence in everyday life is a determinant of quality of life. In reality, some individuals might feel more independent e.g. in supported accommodation than living home with their parents. This is not reflected in the rating creating by Howlin et al (2004) and hence not captured by the model.

8.0 Discussion

The results of the CBAs are summarised in Table 12. This indicates that providing SLT in England, Wales, Scotland and Northern Ireland generates large annual net benefits, and benefit-cost ratios that are higher than 1. In other words, the benefits generated by the interventions exceed the costs, and the interventions represent an efficient use of public resources.

Table 12. Annual net benefits and benefit-cost ratios of SLT (£m in 2009 prices)

Intervention	Patients	Net benefit	Benefit-cost ratio
Dysphagia	63,000	£13.3m	2.32
Aphasia	53,000	£15.4m	1.35
SLI	203,000	£741.8m	6.43
Autism	8,800	£9.8m	1.46

In interpreting these results it is important to keep in mind the following considerations:

1. Given the nature of the interventions, it is difficult to follow-up recipients and measure the full effects on patients. In this evaluation, the analysis of the interventions was limited to a one-off implementation. Continued treatment may lead to additional costs and benefits.
2. The analysis adopted a relatively limited scope in terms of benefits captured. The potential benefits generated by the interventions evaluated are multiple in nature and go beyond avoidance of chest infections, improvement in WAB and improved access to curriculum. For instance in regards to dysphagia, additional benefits of SLT are ability to return to normal diet, functional swallowing, and avoidance of malnutrition, and death. The implications of this limited scope are that the benefits are likely to be underestimated and therefore the net benefits generated by the interventions could be much greater.
3. The models are limited to evaluating the cost and benefit of precisely defined interventions. Caution is required when interpreting the results, as the trial setting makes it possible to deliver a relatively optimal intervention. In routine practise, resource constraints could make it difficult to provide the level of care described in the source papers to all patients.
4. SLT is generally not the only treatment provided to patients, but a part of a multidisciplinary approach to the condition. While the results show a net benefit for increased provision of SLT, the level of other care is assumed constant. Therefore the analysis does not imply that SLT replaces other forms of care.
5. In the dysphagia model, the benefits captured refer to health care cost savings. The benefits for the recipients in terms for example of their well-being are not included. For example, patients with access to SLT are better able to manage their conditions and

would suffer less adverse socio-emotional effects. Thus, the benefits are likely to be underestimated.

6. In the aphasia model, the purpose of the research was to measure the effect of SLT compared to *no SLT*. However, the CBA relied on evidence designed to measure the effect of enhanced NHS SLT versus usual NHS SLT. The CBA is only capturing a portion of the potential total costs and benefits of SLT.
7. The SLI model focuses on primary school children. In practice, a majority of the work by speech and language therapists focuses on pre-school children and the prevention of the development of the condition. Many of the children with the condition in early childhood will experience a spontaneous recovery in absence of treatment. Therefore the population considered is more vulnerable than the average SLI patient.
8. While communication skills are an essential requirement for increased independence for individuals with autism, it is a life-long condition and patients are likely to need assistance throughout their life to cope with everyday tasks. SLT is therefore only a part of a support package necessary to support individuals with the condition.
9. The autism model only considers the cost saving benefits of increased level of independence. It does not consider the value of the improved quality of life for the individual and his family, e.g. the reduced stress caused by lack of understanding between the individual and people around him. It also excludes benefits on education, employment and mental health.
10. The local level estimates are generated by applying the unit cost and benefit of the intervention to the populations eligible for the intervention, using local level population estimates broken down by age. The estimates therefore take into account demographic differences but assume that treatment cost, level of care and prevalence rate are fixed across areas.

Even though the estimated net benefits are subject to uncertainty, the sensitivity analysis suggested that the conclusion that the interventions represent an efficient use of public resources is unlikely to change. While further research is required to evaluate the net impact of SLT on other conditions, the results suggest that investment in SLT provision has potential to deliver benefits that greatly exceed the cost.

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10.0 Appendix 1: effectiveness studies selected for CBAs

Table A1.1. Effectiveness study for modelling dysphagia post-stroke among adults

Reference	Carnaby et al (2006)
Country	Australia (speech pathologist)
Method	RCT; high intensity behavioural therapy (n=102); low intensity NHS SLT (n=102); usual NHS care (n=102)
Setting	Hospital
Age range (time after stroke)	69 – 72 years old (3 days)
Intervention	Low intensity SLT: 0.80 hrs per week for one month High intensity SLT: 1.17 hrs per week for one month
Counterfactual	Usual care by day ward nurse: 0.30 hrs per week for one month
Outcome	Proportion of patients with chest infection

Table A1.2. Effectiveness study for modelling aphasia post-stroke among adults

Reference	Bakheit et al (2006)
Country	UK
Method	RCT; intensive NHS SLT (n= 51); enhanced NHS SLT (n=19); usual NHS SLT (n=19)
Setting	Hospital
Age range (time after stroke)	70 – 73 years old (28-34 days)
Intervention	Intensive NHS SLT: 5hr per week SLT (12 wks) Enhanced NHS SLT: 1.6 hrs per week SLT (12 wks)
Counterfactual	Usual NHS SLT: 0.57 hrs per week (12 wks)
Outcome	Western Aphasia Battery test (WAB) – measures verbal fluency, language, information content, comprehension, repetition, and naming. Quality Adjusted Life Year (QALY) associated with improved communication, self confidence, independence.

Table A1.3. Effectiveness study for modelling SLI among children

Reference	Boyle et al (2007)
Country	UK
Method	RCT; direct individual (n= 34); direct group (n=28); indirect individual (n=33); indirect group (n= 29); control (n= 28)
Setting	School
Age range	6-11 years old
Intervention	Three sessions per week Direct individual: SLT working individually with child (38 sessions) Indirect individual: SLTA working individually with child (38 sessions) Direct group: SLT working with a small group of children (38 sessions) Indirect group: SLTA working with a small group of children (38 sessions)
Counterfactual	Average of 8 sessions with a SLT or SLTA over 15 weeks
Outcome	Primary: standardised scores on the CELF-3 receptive, expressive and total Secondary: standardised scores on the BPVS II (test of receptive vocabulary.

Table A1.4. Effectiveness study for modelling autism among children

Reference	Green et al (2010)
Country	UK
Method	RCT; parent-mediated communication focused intervention - PACT (n= 77); treatment as usual (n=75)
Setting	Local PCT premises
Age range	2 years to 4 years and 11 months
Intervention	SLT sessions with parent and child: 2hrs bi-weekly (6 months) Booster sessions: 2hrs per month (6 months) Treatment as usual
Counterfactual	Treatment as usual (12 months)
Outcome	Parent-child interaction: assessment of parental synchrony, child initiations and shared attention time during naturalistic play in standard setting

11.0 Appendix 2: decision models and data tables

11.1 Dysphagia post-stroke

Figure A2.1 presents a decision model for the impact of the SLT on chest infections in post stroke dysphagia patients. Table A2.1 summarises the data used to populate the model.

Figure A2.1. A decision model for the impact of SLT on likelihood of chest infection in dysphagia post-stroke patients

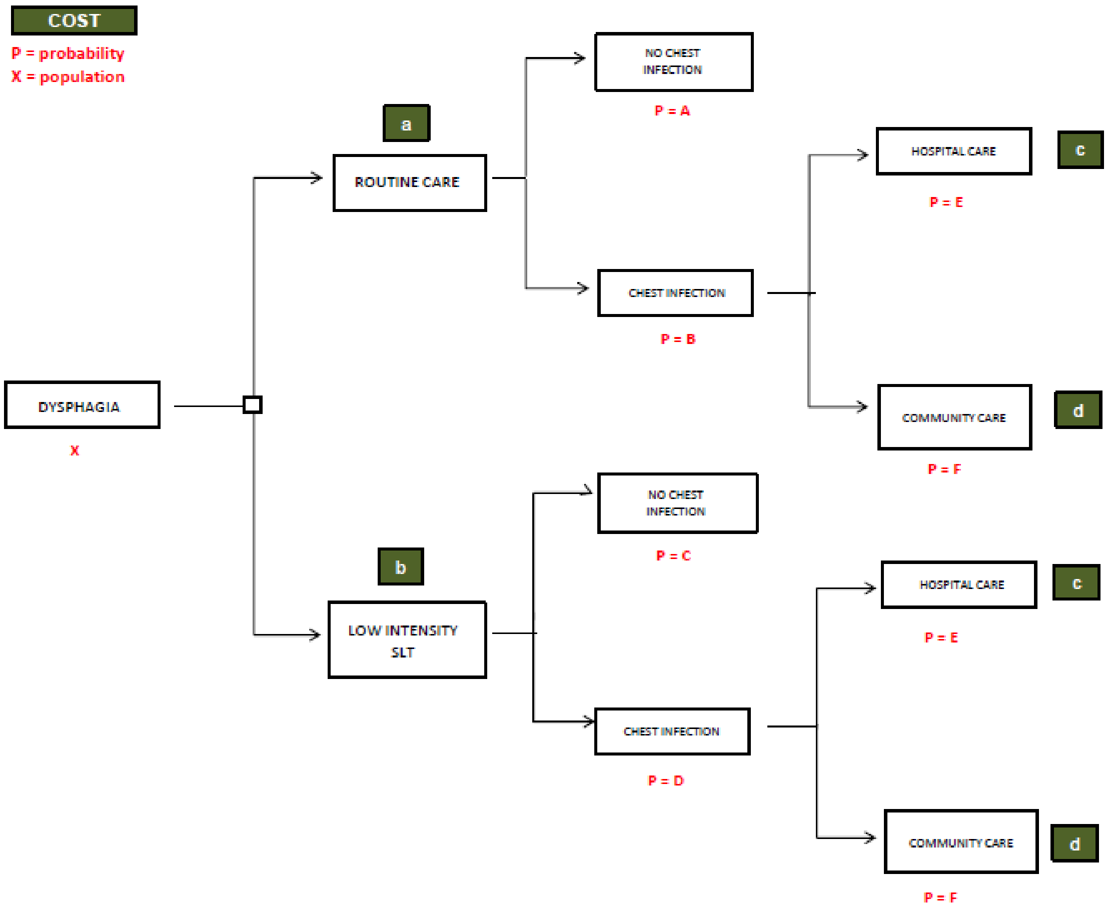

Table A2.1. Parameters used to populate decision model for the impact of SLT on likelihood of chest infection in dysphagia post-stroke patients (monetary values in £2009)

Ref	Description	Value	Calculation and sources
X	Population of dysphagia patients	62,960	Incidence of stroke across all age groups is 0.26 per cent (ONS Health Quarterly Statistics Winter 2001). Probability of dysphagia in post stroke patients = 78 per cent (RCSLT Resource manual for commissioning and planning services for SLCN: Dysphagia). Probability that dysphagia patients require SLT = 51 per cent (Mann et al, xxxx). Incidence of dysphagia = 0.26 per cent * 78 per cent * 51 percent = 0.10 per cent Total UK population = 61, 049,168 (ONS mid 2008 estimates for local authorities, Office for National Statistics; General Registrar Office for Scotland, Department of Health, Social Services, and Public Safety (2008): Strategic Resources Framework.) Dysphagia patients = 61,049,168 * 0.10 per cent = 62,960.
a	Unit cost NHS day ward nurse	£58	Carnaby et al (2005) estimated total NHS care = 4.8 session, 16.0 min per session = 76.8 min = 1.28 hours. Unit cost of a Band 5 NHS day ward nurse estimated by Curtis (2009) = £45 per hour with patient. The 2008/2009 cost of a nurse was adjusted to 2009 prices using the GDP deflator = £45.7. Cost per dysphagia patient receiving NHS care = £45.70 * 1.28 = £58
b	Unit cost of hospital SLT	£219	Carnaby et al (2005) estimated total treatment with SLT = 7.8 session, 24.8 min per session = 193.44 min = 3.224 hours. Unit cost of a Band 5 hospital SLT estimated by Curtis (2009) = £44 per hour with patient. The cost of a Band 5 SLT was uplifted to Band 7 based on the ratio of the annual salaries = (Band 7 = £35,900 per year/ Band 5 = £23,400 per year) = 1.53. £44 * 1.53 = £67. The 2008/2009 cost of a SLT was adjusted to 2009 prices using the GDP deflator = £68. Cost per dysphagia patient receiving SLT = £68 * 3.224 = £219

Ref	Description	Value	Calculation and sources
A	Probability dysphagia patient will develop a chest infection with NHS care	0.471	Carnaby et al (2005) - out of 102 patients receiving NHS care, 48 developed a chest infection = 48/102 = 0.471
B	Probability dysphagia patient will not develop a chest infection with NHS care	0.529	1 – ProbA
C	Probability dysphagia patient will develop a chest infection with SLT care	0.255	Carnaby et al (2005) - out of 102 patients receiving SLT (low intensity), 26 developed a chest infection = 26/102 = 0.255
D	Probability dysphagia patient will not develop a chest infection with SLT care	0.745	1 - ProbC
E	Probability if patient develops chest infection that it requires hospital admission	0.32	Guest and Morris (1997)
F	Probability if patient develops chest infection that it requires community care	0.68	Guest and Morris (1997)
c	Unit cost chest infection requiring hospital care	£5,084	Guest and Morris (1997) - in 1992/93 prices a cost of chest infection treated in hospital = £1700 - £5100 per case. Average updated to 2009 prices using GDP deflator.
d	Unit cost chest infection requiring community care	£150	Guest and Morris (1997) - in 1992/93 prices a cost of chest infection treated in the community = £100 per case. Updated to 2009 prices using GDP deflator.

11.2 Aphasia post-stroke

Figure A2.2 presents a decision model for the impact of the SLT on QALY gain in post stroke aphasia patients. Table A2.2 summarises the data used to populate the model.

Figure A2.2. A decision model for the impact of SLT on QALYs in aphasia post-stroke patients

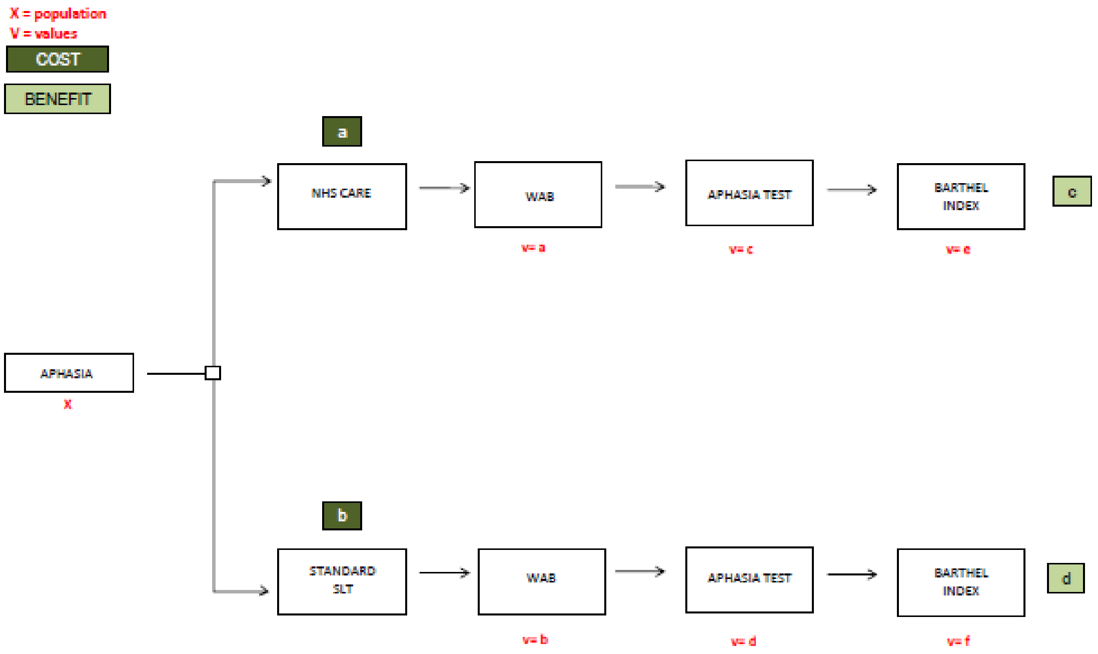

Table A2.2. Parameters used to populate decision model for the impact of SLT on QALYs in aphasia post-stroke patients (monetary values in £2009)

Ref	Description	Value	Calculation and sources
X	Population of aphasia patients	52,645	Incidence of stroke across all age groups is 0.26 per cent (ONS Health Quarterly Statistics Winter 2001). Probability of dysphagia in post stroke patients = 33.33 per cent (RCSLT Resource manual for commissioning and planning services for SLCN: Aphasia). Incidence of aphasia = 0.26 per cent * 33.33 per cent = 0.09 per cent Total UK population = 61, 049,168 (ONS, General Registrar Office for Scotland, Department of Health, Social Services, and Public Safety (2008). Aphasia patients = 61,049,168 * 0.09 per cent = 52,645.
a	Unit cost usual NHS SLT	£469	Bakheit et al (2007) estimated total usual NHS SLT = 6.9 hours per patient. Unit cost of Band 5 community NHS SLT estimated by Curtis (2009) = £44 per hour with patient. The cost of a Band 5 SLT was uplifted to Band 7 based on the ratio of the annual salaries = (Band 7 = £35,900 per year/ Band 5 = £23,400 per year) = 1.53. £44 * 1.53 = £67. The 2008/2009 cost of a SLT was adjusted to 2009 prices using the GDP deflator = £68. Cost per aphasia patient receiving NHS therapy = £68 * 6.9 = £469
b	Unit cost of enhanced NHS SLT	£1313	Bakheit et al (2007) estimated total enhanced NHSSLT = 19.3 hours per patient. Unit cost of Band 5 community NHS SLT estimated by Curtis (2009) = £44 per hour with patient. The cost of a Band 5 SLT was uplifted to Band 7 based on the ratio of the annual salaries = (Band 7 = £35,900 per year/ Band 5 = £23,400 per year) = 1.53. £44 * 1.53 = £67. The 2008/2009 cost of a SLT was adjusted to 2009 prices using the GDP deflator = £68. Cost per aphasia patient receiving standard SLT therapy = £68 * 19.3 = £1313

Ref	Description	Value	Calculation and sources
a	Effect of NHS therapy on WAB test	42.58%	Bakheit et al (2007) state those receiving NHS care improved their WAB score from a baseline of 45.8 to 65.3. Percentage improvement = (65.3-45.8)/45.8 = 42.58 per cent
b	Effect of SLT on WAB test	79.42%	Bakheit et al (2007) state those receiving the standard SLT improved their WAB score from a baseline of 37.9 to 68. Percentage improvement = (68 -37.9)/37.9 = 79.42 per cent
c	Conversion of improvement in WAB test from NHS therapy to aphasia test provided in Wade et al (1985)	Baseline: 9.2 24 wks: 13.1	The WAB test is out of 1 to100. The aphasia test used in Wade et al is out of 0 to 20. Assuming both tests have a similar distribution the mean score at baseline on the aphasia test used in Wade et al (1985) = (45.8/100) * 20 = 9.2. The score on the aphasia test post SLT = 9.2 * 42.58 per cent = 13.1
d	Conversion of improvement in WAB test from standard SLT to aphasia test provided in Wade et al (1985)	Baseline: 7.6 24 wks: 13.6	The WAB test is out of 1 to100. The aphasia test used in Wade et al is out of 0 to 20. Assuming the two tests have a similar distribution the mean score at baseline on the aphasia test used in Wade et al (1985) = (37.9/100) * 20 = 7.6. The score on the aphasia test post SLT = 7.6 * 79.42 per cent = 13.6
e	Conversion of aphasia test score from NHS therapy to Barthel Index.	Baseline: 5.32 24 wks: 7.82	The Barthel index (BI) measures the ability of patients to perform daily living activity ranging from 0 to 20, with 20 being independent and functional. Wade et al (1985) state that an aphasia score of 14 and below is equivalent to a BI score of 8.4, and an aphasia score greater than 14 is equivalent to a BI score of 12.8. A linear relationship is assumed between the aphasia test and BI. An aphasia score of 9.2 = BI score of 5.32. An aphasia score of 13.1 = BI score of 7.82.
f	Conversion of aphasia test score from standard SLT to Barthel Index.	Baseline: 4.30 24 wks: 8.14	The Barthel index (BI) measures the ability of patients to perform daily living activity ranging from 0 to 20, with 20 being independent and functional. Wade et al (1985) state that an aphasia score of 14 and below is equivalent to a BI score of 8.4, and an aphasia score greater than 14 is equivalent to a BI score of 12.8. A

Ref	Description	Value	Calculation and sources
			linear relationship is assumed between the aphasia test and BI. An aphasia score of 7.6 = BI score of 4.30. An aphasia score of 13.6 = BI score of 8.14.
c	Conversion of BI score from NHS therapy to QALY gain	0.120	Exel at el (2004) provide a linear regression analysis to show the relationship between BI and QALY values. A BI score of 5.32 = 0.104 QALYs, a BI score of 7.82 = 0.224 QALYs. Incremental QALY gain = 0.224 – 0.104 = 0.120
d	Conversion of BI score from standard SLT to QALY gain	0.177	Exel at el (2004) provide a linear regression analysis to show the relationship between BI and QALY values. A BI score of 4.30 = 0.062 QALYs, a BI score of 8.14 = 0.239 QALYs. Incremental QALY gain = 0.239 – 0.062 = 0.177

11.3 Children with speech and language impairment

Figure A2.3 presents a decision model for the impact of the SLT on SLI patients. Table A2.3 summarises the data used to populate the model.

Figure A2.3. A decision model for the impact of SLT on educational achievement in children with SLI

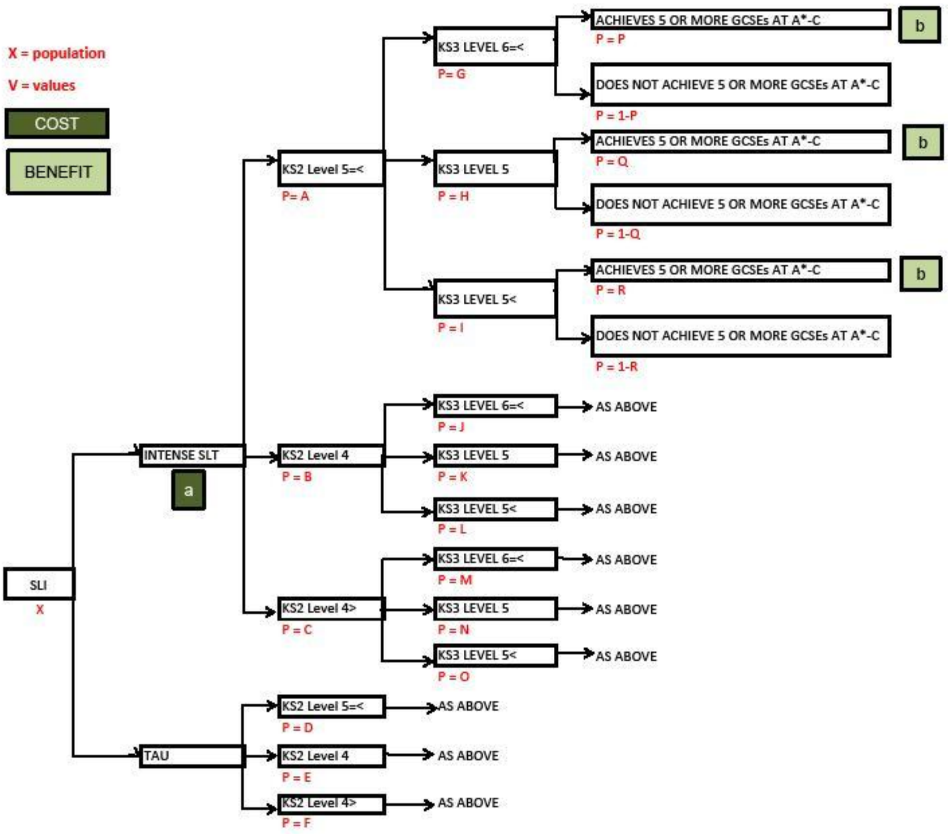

Table A2.3. Parameters used to populate decision model for the impact of SLT on educational achievement in children with SLI (monetary values in £2009)

Ref	Description	Value	Calculation and sources
X	Number of children affected	202,663	Median prevalence estimate (birth to 7 years) is 5.9 per cent. UK population 2009, aggregated from country level data for persons 6-10 years (inc), is 3,434,972. a = 0.059*3,434,972 = 202,663. Source: Law et al (1998), ONS (2010), General Registrar Office for Scotland, Department of Health, Social Services, and Public Safety (2008).
A	Student achieves KS2 L5<= if intervention	14%	A = 1 - (B+C)
B	Student achieves KS2 L4 if intervention	34%	The mean CELF expressive score was 67.82 and 68.23 at T1 for direct individual and direct group respectively (average 68.03). At T2 the mean scores were 72.59 and 71.87 respectively (average 72.23). For the control group, the mean score was 70.16 at T1 and 70.84 at T2. Source: Boyle et al (2007) Effect size = (68.03*(70.84/70.16)-72.23)/(68.03*(70.84/70.16)) = 0.052 The threshold mark for L4 is 46. The threshold mark for L5 is 71. Source: DCSF "National Curriculum Assessments at Key Stage 2 in England 2008/09" The proportion of students achieving L3 or below at baseline is 56% (F). The proportion of students achieving L4 at baseline is 36% (E). Proportion of L3 students moving up to L4 = (46 - 46/(1+0.052))/(46-0) = 5%

Ref	Description	Value	Calculation and sources
			Proportion of L4 students moving up to L5 = (71 - 71/(1+0.052))/(71-46) = 14% Proportion of L4 students in SLI distribution = 36% + 0.05*56% - 0.14*36% = 34%%
C	Student achieves KS2 L4> if intervention	53%	See B for calculation of effect size. The threshold mark for L4 is 46. Source: DCSF "National Curriculum Assessments at Key Stage 2 in England 2008/09" The proportion of students achieving L3 or below at baseline is 56% (F). Proportion of L3 students moving up to L4 = (46 - 46/(1+0.052))/(46-0) = 5% Proportion of L3 students in SLI distribution = (1-0.05)*56% = 53%
D	Student achieves KS2 L5<= if no intervention	9%	D = 1 - (E+F)
E	Student achieves KS2 L4 if no intervention	36%	The mean KTEA score for the individuals who score low overall in a battery of speech and language tests is 84.03, 72 per cent of the mean score of 116.23 for the group scoring within normal range. Source: Beitchman et al (1996) The average KS2 score in 2004 was 27.5. Using the prevalence rate of 5.9 per cent and the ratio above, the average score for students with SLI is calculated. (27.5/(0.059*0.72+0.941*1))*0.72 = 20.2 20.2/27.5 = 73.5% Source: DCSF "National Curriculum Assessments at Key Stage 2 in England 2008/09", Law et al (1998) The threshold mark for L4 and L5 is 46 and 71

Ref	Description	Value	Calculation and sources
			respectively. The extrapolated top mark (for L5) is 108. The proportion of students achieving L4 and L5 are 46 and 29 per cent respectively. Source: DCSF "National Curriculum Assessments at Key Stage 2 in England 2008/09" Proportion of L4 students moving down to L3 = (46/0.735 - 46)/(71-46) = 66% Proportion of L5 students moving down to L4 = (71/0.735 - 71)/(108-71) = 70% Proportion of L4 students in SLI distribution = 46% - 66%*46% + 70%*29% = 36%
F	Student achieves KS2 L4> if no intervention	56%	See E for the estimation of the relative performance of students with SLI compared to national average (73.5%). The threshold mark for L4 and L5 is 46 and 71 respectively. The proportion of students achieving L3 or below and L4 are 25 per cent and 46 per cent respectively. Source: DCSF "National Curriculum Assessments at Key Stage 2 in England 2008/09" Proportion of L4 students moving down to L3 = (46/0.735 - 46)/(71-46) = 66% Proportion of L3 students in SLI distribution = 25% + 66%*46% = 56%
G	Student achieves KS3 L6<= if KS2 L5<=	71%	Out of SEN students who performed on average at L5 in KS2 assessments, 51, 88 and 74 per cent achieved L6 or more at KS3 in 2002 in English, Math and Science respectively. (51%+88%+74%)/3 = 71% Source: DfES "Pupils Progress 2002"

Ref	Description	Value	Calculation and sources
H	Student achieves KS3 L5 if KS2 L5<=	22%	Out of SEN students who performed on average at L5 in KS2 assessments, 86, 97 and 95 per cent achieved L5 or more at KS3 in 2002 in English, Math and Science respectively. When the proportion of students who achieved L6 or more (51, 88 and 74 per cent) are removed, the percentages receiving L5 are 35, 9 and 21 per cent respectively. (35%+9%+21%)/3 = 22% Source: DfES "Pupils Progress 2002"
I	Student achieves KS3 L5> if KS2 L5<=	7%	I = 1 - (G+H)
J	Student achieves KS3 L6<= if KS2 L4	20%	Out of SEN students who performed on average at L4 in KS2 assessments, 11, 29 and 19 per cent achieved L6 or more at KS3 in 2002 in English, Math and Science respectively. (11%+29%+19%)/3 = 20% Source: DfES "Pupils Progress 2002"
K	Student achieves KS3 L5 if KS2 L4	41%	Out of SEN students who performed on average at L4 in KS2 assessments, 50, 67 and 66 per cent achieved L5 or more at KS3 in 2002 in English, Math and Science respectively. When the proportion of students who achieved L6 or more (11, 29 and 19 per cent) are removed, the percentages receiving L5 are 39, 38 and 47 per cent respectively. (39%+38%+47%)/3 = 41% Source: DfES "Pupils Progress 2002"
L	Student achieves KS3 L5> if KS2 L4	39%	L = 1 - (J+K)
M	Student achieves KS3 L6<= if KS2 L4>	1%	Out of SEN students who performed on average at L3 in KS2 assessments, 1, 2 and 2 per cent achieved L6 or more at KS3 in 2002 in English, Math and Science respectively. Out of students who performed on average at LB3 in KS2

Ref	Description	Value	Calculation and sources
			assessments, 0, 0 and 0 per cent achieved L6 or more at KS3 in 2002 in English, Math and Science respectively. In 2002, 15 per cent of students achieved on average L3 and 6 per cent less than L3 (LB3). ((1%+2%+2%)/3)*(0.15/(0.15+0.06))+((0%+0%+0%)/3)*(0.06/(0.15+0.06)) = 1% Source: DfES "Pupils Progress 2002", DCSF "National Curriculum Assessments at Key Stage 2 in England 2008/09"
N	Student achieves KS3 L5 if KS2 L4>	12%	Out of SEN students who performed on average at L3 in KS2 assessments, 17, 13 and 19 per cent achieved L5 or more at KS3 in 2002 in English, Math and Science respectively. Removing the proportion of students who achieved L6 or more (1, 2 and 2 per cent), the percentage of students achieving L5 is 16, 12 and 17 per cent respectively. Out of students who performed on average at LB3 in KS2 assessments, 3, 1 and 2 per cent achieved L5 or more at KS3 in 2002 in English, Math and Science respectively. Removing the proportion of students who achieved L6 or more (0, 0 and 0 per cent), the percentage of students achieving L5 is 3, 1 and 2 per cent respectively. In 2002, 15 per cent of students achieved on average L3 and 6 per cent less than L3 (LB3). ((16%+12%+17%)/3)*(0.15/(0.15+0.06))+((3%+1%+2%)/3)*(0.06/(0.15+0.06)) = 12% Source: DfES "Pupils Progress 2002", DCFS "National Curriculum Assessments at Key Stage 2 in England 2008/09"
O	Student achieves KS3 L5> if KS2 L4>	87%	O = 1 - (M+N)
P	Student achieves 5+ GCSEs at A*-C if KS3 L6<=	92%	Out of SEN students who performed on average at L6, L7 and L8 in KS3 assessments, 81, 96 and 99 per cent gained 5+ GCSEs at A*-C respectively in 2002.

Ref	Description	Value	Calculation and sources
			(81%+96%+99%)/3 = 92% Source: DfES "Pupils Progress 2002"
Q	Student achieves 5+ GCSEs at A*-C if KS3 L5	33%	Out of SEN students who performed on average at L5 in KS3 assessments, 33 per cent gained 5+ GCSEs at A*-C in 2002. Source: DfES "Pupils Progress 2002"
R	Student achieves 5+ GCSEs at A*-C if KS3 L5>	2%	Out of SEN students who performed on average at LB3, L3 and L4 in KS3 assessments, 1, 0 and 4 per cent gained 5+ GCSEs at A*-C respectively in 2002. (1%+0%+4%)/3 = 2% Source: DfES "Pupils Progress 2002"
a	Incremental cost of the intervention	£674	The unit cost of one hour of client contact for a community speech and language therapist (Band 5) is £44. The ratio between annual salary for Band 5 and Band 7 is used to uplift the cost. (35,900/23,400)*£44 = £67.50 The mean number of sessions is 38 and 8 for intervention and control respectively. One session lasts 30 minutes. Out of the 62 children receiving direct intervention, 34 receive individual and 28 group therapy. The number of children in a group is assumed to be 4. (34/62)*((38-8)/2)*67.50+(28/62)*(((38-8)/2*67.50)/4) = 674 Source: Boyle et al (2007)
b	Gain in adult earnings from achieving 5 GCSE's A*-C	£160,053	Gain in adult earnings from achieving 5 GCSE's A*-C compared to 5 GCSE's A*-G. Uplifted to 2009 prices. Source: Cummings et al (2007)

11.4 Children with autism

Figure A2.4 presents a decision model for the impact of the SLT on autistic patients. Table A2.4 summarises the data used to populate the model.

Figure A2.4. A decision model for the impact of SLT on living outcomes in children with autism

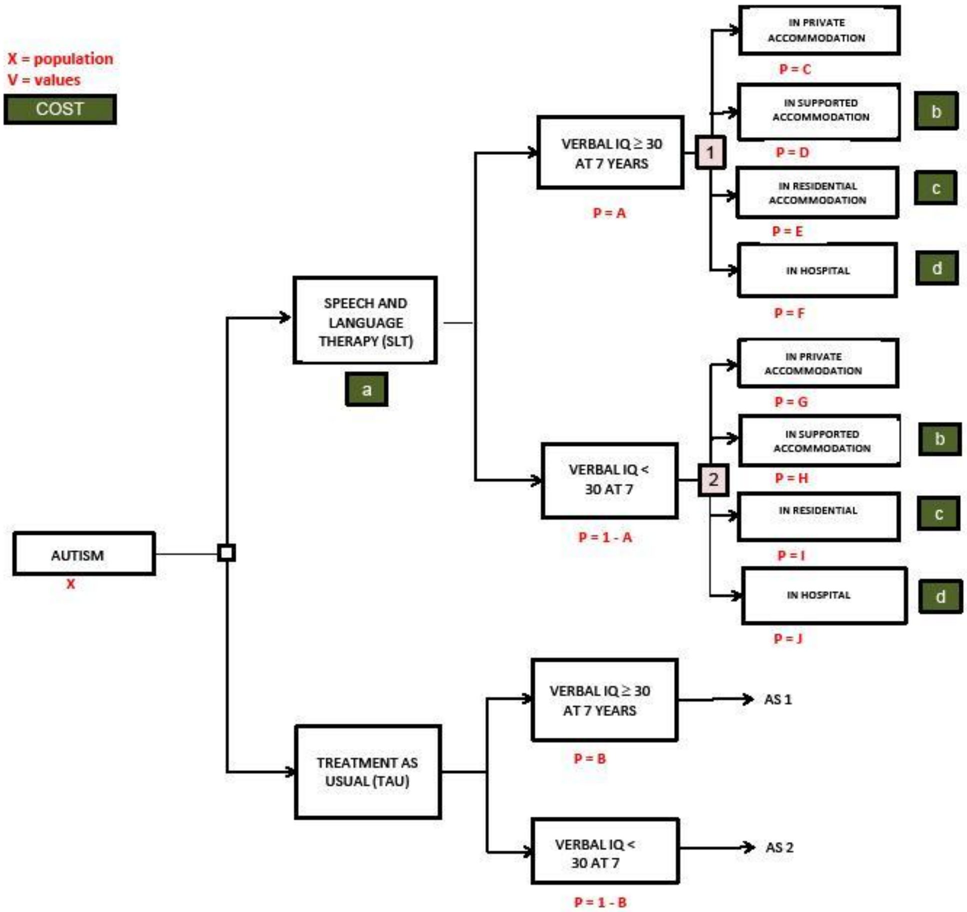

Table A2.4. Parameters used to populate decision model for the impact of SLT on living outcomes in children with autism (monetary values in £2009)

Ref	Description	Value	Calculation and sources
x	Autistic population considered	8,826	Estimated prevalence of core disorder is 0.4 per cent. UK population 2009, persons 2-4 years (inc), aggregated from country level data is 2,190,717. x = 0.004*2,190,717 = 8,763. Source: Green et al (2010), ONS (2010), General Registrar Office for Scotland, Department of Health, Social Services, and Public Safety (2008).
A	Verbal IQ greater or equal to 30 at 7 years if SLT intervention	55.9%	Parental synchronisation for participants receiving the intervention was 0.318 at baseline and 0.513 at the end of the intervention. For the participants in the control group the baseline synchronisation was 0.313 and 0.326 at the end of the intervention. Effect size = (0.513-(0.318*(0.326/0.313)))/(0.318*(0.326/0.313)) = 0.55 Source: Green et al (2010) Mean synchronisation score is 1.01. The coefficient of synchronisation on the logarithm of rate of change in language age is 0.407. Language growth is reported 12, 24 and 44 months after intervention. The growth rates (from previous period) are 30, 27 and 38 per cent respectively. The intervention effect is applied to each growth rate. 30%*(1+1.01*0.55*0.407) = 36% 27%*(1+1.01*0.55*0.407) = 34% 38%*(1+1.01*0.55*0.407) = 47% The language age after the intervention is therefore 16.6*1.36*1.34*1.47 = 44.4 Language age by the age of 89 months is 37.9 months before intervention. The incremental difference is 6.5 months.

Ref	Description	Value	Calculation and sources
			Source: Siller and Sigman (2008) In a follow up study by Howlin et al (2004), a distribution of verbal IQ at 7 is described for the sample. This is used as a baseline. 31 (46 per cent) of participants had a verbal IQ of 30 or less: 29 of them did not achieve a score, and the lowest achieved score was 21. The remaining participant in this category is assumed to score the mid-point between 21 and 30, 25.5. 37 participants had a verbal IQ score greater than 30. Verbal IQ = Language age/Chronological age * 100 Language age for verbal IQ 30 at the mean age of final assessment in Siller and Sigman (2008) = (30/100)*89 = 26.7 Cut-off language age at 89 for the intervention to make a difference = 26.7 - 6.5 = 20.2 Cut-off verbal IQ at 89 months for the intervention to make a difference = (20.2/89)*100 = 22.7 As a consequence of the intervention, 38 participants would score over 30 in a verbal IQ test. 38/68 = 55.9%.
B	Verbal IQ greater or equal to 30 at 7 years if TAU	54.4%	In a follow up study by Howlin et al (2004), a distribution of verbal IQ at 7 is described for the sample. This is used as a baseline. 31 (46 per cent) of participants had a verbal IQ of 30 or less and 37 participants had a verbal IQ score greater than 30. 37/68 = 54.4%
J	In private accommodation if verbal IQ greater or equal to 30 at 7 years	58.6%	Mean residential status score for individuals with a childhood verbal IQ score of more than 30 is 2.69, with standard deviation 1.43. Assuming normal distribution, probability of scoring 0 (living independently), 1 (in semi-sheltered accommodation or still home) or 2 (living with parents, some limited autonomy) = 59% Source: Howlin et al (2004)

Ref	Description	Value	Calculation and sources
K	In supported accommodation if verbal IQ greater or equal to 30 at 7 years	23.4%	Mean residential status score for individuals with a childhood verbal IQ score of more than 30 is 2.69, with standard deviation 1.43. Assuming normal distribution, probability of scoring 3 (in residential accommodation with some limited autonomy) = 23% Source: Howlin et al (2004)
L	In residential accommodation if verbal IQ greater or equal to 30 at 7 years	12.7%	Mean residential status score for individuals with a childhood verbal IQ score of more than 30 is 2.69, with standard deviation 1.43. Assuming normal distribution, probability of scoring 4 (special autistic or other residential accommodation with little or no autonomy) = 13% Source: Howlin et al (2004)
M	In hospital accommodation if verbal IQ greater or equal to 30 at 7 years	5.3%	M = 1 - J - K - L
N	In private accommodation if verbal IQ less than 30 at 7 years	35.1%	Mean residential status score for individuals with a childhood verbal IQ score of 30 or less is 3.74, with standard deviation 1.93. Assuming normal distribution, probability of scoring 0 (living independently), 1 (in semi-sheltered accommodation or still home) or 2 (living with parents, some limited autonomy) = 35% Source: Howlin et al (2004)
O	In supported accommodation if verbal IQ less than 30 at 7 years	20.3%	Mean residential status score for individuals with a childhood verbal IQ score of 30 or less is 3.74, with standard deviation 1.93. Assuming normal distribution, probability of scoring 3 (in residential accommodation with some limited autonomy) = 20% Source: Howlin et al (2004)

Ref	Description	Value	Calculation and sources
P	In residential accommodation if verbal IQ less than 30 at 7 years	18.9%	Mean residential status score for individuals with a childhood verbal IQ score of 30 or less is 3.74, with standard deviation 1.93. Assuming normal distribution, probability of scoring 4 (special autistic or other residential accommodation with little or no autonomy) = 19% Source: Howlin et al (2004)
Q	In hospital accommodation if verbal IQ less than 30 at 7 years	25.7%	Q = 1 - N - O - P
a	Unit cost of intervention	£2,430	The intervention consists of 12 sessions and 6 booster sessions, each 2 hours. The unit cost of one hour of client contact for a community speech and language therapist (Band 5) is £44. The ratio between annual salary for Band 5 and Band 7 is used to uplift the cost. (35,900/23,400)*£44 = £67.50 (12+6)*2*£67.50 = £2,430 Source: Green et al (2010), Curtis et al (2010)
b	Lifetime incremental cost of supported accommodation	£876,277	The annual cost of autism for an individual in private accommodation is £36,507. The annual cost for an individual in a residential accommodation with limited autonomy is £87,937. Annual incremental cost = £87,937 - £36,507 = 51,430 Updated to 2009 prices. The annual cost is applied from the age of 18 for 63 years, the expectation of life at 18. The costs are discounted using a discount rate of 3.5 per cent. Source: Knapp et al (2009), Period and cohort expectation of life tables (ONS, 2009)

Ref	Description	Value	Calculation and sources
c	Lifetime incremental cost of residential accommodation	£893,315	The annual cost of autism for an individual in private accommodation is £36,507. The annual cost for an individual in a residential accommodation with limited autonomy is £88,937. Annual incremental cost = £88,937 - £36,507 = £52,430 Updated to 2009 prices. The annual cost is applied from the age of 18 for 63 years, the expectation of life at 18. The costs are discounted using a discount rate of 3.5 per cent. Source: Knapp et al (2009), Period and cohort expectation of life tables (ONS, 2009)
d	Lifetime incremental cost of hospital accommodation	£1,045,398	The annual cost of autism for an individual in private accommodation is £36,507. The annual cost for an individual in a residential accommodation with limited autonomy is £88,937. Annual incremental cost = £97,863 - £36,507 = £61,356 Updated to 2009 prices. The annual cost is applied from the age of 18 for 63 years, the expectation of life at 18. The costs are discounted using a discount rate of 3.5 per cent. Source: Knapp et al (2009), Period and cohort expectation of life tables (ONS, 2009)

12.0 Appendix 3: findings at local level

12.1 Dysphagia post stroke

Table A3.1 provides the local level analysis of the impact of SLT in dysphagia post-stroke patients.

12.2 Aphasia post stroke

Table A3.2 provides the local level analysis of the impact of SLT in aphasia post-stroke patients.

12.3 Children with speech and language impairment

Table A3.3 provides the local level analysis of the impact of SLT in children with SLI

12.4 Children with autism

Table A3.4 provides the local level analysis of the impact of SLT in children with autism

Table A3.1. Local level analysis of the impact of SLT in dysphagia post-stroke patients (£ in 2009 prices based on: unit benefit, £373; unit cost, £161; unit net benefit, £212)

Country/Local subgroup	Total number of dysphagia patients	Total cost	Total benefit	Total net benefit
Total Population: England, Wales, NI, Scotland	62,960	£10,123,484	£23,471,544	£13,348,060
England (by Strategic Health Authority)	52,711	£8,475,566	£19,650,806	£11,175,240
North East	2,644	£425,109	£985,626	£560,517
North West	7,105	£1,142,435	£2,648,764	£1,506,329
Yorkshire and the Humber	5,354	£860,830	£1,995,855	£1,135,025
East Midlands	4,488	£721,610	£1,673,071	£951,461
West Midlands	5,561	£894,092	£2,072,975	£1,178,883
East of England	5,842	£939,428	£2,178,087	£1,238,659
London	7,847	£1,261,791	£2,925,493	£1,663,702
South East Coast	4,405	£708,303	£1,642,218	£933,915
South Central	4,155	£668,049	£1,548,889	£880,839
South West	5,311	£853,917	£1,979,828	£1,125,911

Country/Local subgroup	Total number of dysphagia patients	Total cost	Total benefit	Total net benefit
Wales (by Unitary Local Authority)	3,081	£495,433	£1,148,674	£653,241
Monmouthshire	95	£15,244	£35,344	£20,100
Gwynedd	125	£20,111	£46,629	£26,517
Pembrokeshire	116	£18,648	£43,237	£24,588
Ceredigion	98	£15,725	£36,459	£20,734
Neath Port Talbot	136	£21,899	£50,774	£28,875
Swansea	237	£38,103	£88,342	£50,240
Conwy	113	£18,215	£42,232	£24,017
Cardiff	336	£54,035	£125,281	£71,246
Rhondda Cynon Taff	240	£38,650	£89,610	£50,961
Anglesey	66	£10,570	£24,506	£13,936
Caerphilly	179	£28,800	£66,774	£37,974
Bridgend	149	£23,893	£55,396	£31,503
Wrexham	143	£23,033	£53,402	£30,369
Flintshire	147	£23,671	£54,882	£31,211
Vale of Glamorgan	121	£19,480	£45,165	£25,685
Carmarthenshire	175	£28,167	£65,305	£37,138
Merthyr Tydfil	56	£8,949	£20,747	£11,799
Newport	140	£22,497	£52,161	£29,663
Denbighshire	102	£16,455	£38,151	£21,696
Blaenau Gwent	75	£12,005	£27,833	£15,828
Torfaen	93	£15,014	£34,810	£19,796
Powys	139	£22,270	£51,633	£29,363

Country/Local subgroup	Total number of dysphagia patients	Total cost	Total benefit	Total net benefit
Scotland (by Local Authority)	5,345	£859,450	£1,992,656	£1,133,206
Aberdeen City	220	£35,395	£82,063	£46,669
Aberdeenshire	251	£40,293	£93,420	£53,127
Angus	113	£18,235	£42,279	£24,043
Argyll & Bute	93	£14,909	£34,567	£19,658
Clackmannanshire	52	£8,356	£19,374	£11,018
Dumfries & Galloway	153	£24,573	£56,972	£32,400
Dundee City	148	£23,745	£55,054	£31,309
East Ayrshire	124	£19,890	£46,115	£26,225
East Dunbartonshire	108	£17,325	£40,168	£22,843
East Lothian	100	£16,018	£37,138	£21,120
East Renfrewshire	92	£14,777	£34,260	£19,483
Edinburgh, City of	492	£79,030	£183,233	£104,203
Eilean Siar	27	£4,319	£10,013	£5,695
Falkirk	157	£25,251	£58,545	£33,294
Fife	374	£60,133	£139,420	£79,287
Glasgow City	606	£97,381	£225,780	£128,399
Highland	227	£36,487	£84,596	£48,109
Inverclyde	83	£13,271	£30,769	£17,498
Midlothian	83	£13,370	£30,999	£17,629
Moray	90	£14,512	£33,646	£19,134
North Ayrshire	139	£22,422	£51,985	£29,563
North Lanarkshire	336	£53,994	£125,186	£71,192
Orkney Islands	21	£3,309	£7,673	£4,364
Perth & Kinross	150	£24,143	£55,975	£31,832

Country/Local subgroup	Total number of dysphagia patients	Total cost	Total benefit	Total net benefit
Renfrewshire	175	£28,130	£65,221	£37,091
Scottish Borders	116	£18,632	£43,199	£24,567
Shetland Islands	23	£3,690	£8,555	£4,865
South Ayrshire	115	£18,434	£42,739	£24,305
South Lanarkshire	320	£51,446	£119,278	£67,832
Stirling	91	£14,694	£34,068	£19,374
West Dunbartonshire	93	£15,025	£34,836	£19,811
West Lothian	176	£28,312	£65,643	£37,331

Country/Local subgroup	Total number of dysphagia patients	Total cost	Total benefit	Total net benefit
Northern Ireland (by Local Commissioning Boards)	1,822	£293,034	£679,407	£386,373
Belfast LCG	344	£55,331	£128,286	£72,955
Northern LCG	466	£74,855	£173,552	£98,698
South Eastern LCG	349	£56,061	£129,978	£73,917
Southern LCG	359	£57,691	£133,758	£76,067
Western LCG	305	£49,097	£113,833	£64,736

Table A3.2. Local level analysis of the impact of SLT in aphasia post-stroke patients (£ in 2009 prices based on: unit benefit, £1,136; unit cost, £843; unit net benefit, £293)

Country/Local subgroup	Aphasia patients	Total cost	Total benefit	Total net benefit
Total Population: England, Wales, NI, Scotland	52,757	£44,395,631	£59,804,417	£15,408,785
England (by Strategic Health Authority)	44,169	£37,247,923	£50,175,890	£12,927,967
North East	2,215	£1,868,245	£2,516,673	£648,428
North West	5,954	£5,020,708	£6,763,290	£1,742,582
Yorkshire and the Humber	4,486	£3,783,125	£5,096,167	£1,313,043
East Midlands	3,761	£3,171,290	£4,271,978	£1,100,688
West Midlands	4,659	£3,929,305	£5,293,084	£1,363,779
East of England	4,896	£4,128,544	£5,561,475	£1,432,930
London	6,576	£5,545,246	£7,469,884	£1,924,638
South East Coast	3,691	£3,112,810	£4,193,200	£1,080,390
South Central	3,481	£2,935,905	£3,954,895	£1,018,991
South West	4,450	£3,752,746	£5,055,244	£1,302,499

Country/Local subgroup	Aphasia patients	Total cost	Total benefit	Total net benefit
Wales (by Unitary Local Authority)	2,582	£2,177,302	£2,932,997	£755,695
Monmouthshire	79	£66,995	£90,248	£23,253
Gwynedd	105	£88,385	£119,061	£30,676
Pembrokeshire	97	£81,955	£110,400	£28,445
Ceredigion	82	£69,108	£93,095	£23,986
Neath Port Talbot	114	£96,242	£129,646	£33,404
Swansea	199	£167,452	£225,571	£58,119
Conwy	95	£80,049	£107,833	£27,783
Cardiff	282	£237,469	£319,890	£82,421
Rhondda Cynon Taff	201	£169,856	£228,809	£58,953
Anglesey	55	£46,451	£62,573	£16,122
Caerphilly	150	£126,569	£170,499	£43,930
Bridgend	125	£105,002	£141,446	£36,444
Wrexham	120	£101,223	£136,355	£35,132
Flintshire	123	£104,028	£140,134	£36,106
Vale of Glamorgan	102	£85,610	£115,323	£29,713
Carmarthenshire	147	£123,785	£166,748	£42,963
Merthyr Tydfil	47	£39,326	£52,976	£13,649
Newport	117	£98,871	£133,186	£34,316
Denbighshire	86	£72,314	£97,413	£25,099
Blaenau Gwent	63	£52,757	£71,068	£18,311
Torfaen	78	£65,983	£88,884	£22,901
Powys	116	£97,871	£131,839	£33,969

Country/Local subgroup	Total number of aphasia patients	Total cost	Total benefit	Total net benefit
Scotland (by Local Authority)	4,367	£3,682,597	£4,960,748	£1,278,152
Aberdeen City	184	£154,169	£207,677	£53,509
Aberdeenshire	210	£165,077	£222,372	£57,295
Angus	95	£78,539	£105,798	£27,259
Argyll & Bute	78	£66,176	£89,145	£22,968
Clackmannanshire	44	£34,906	£47,021	£12,115
Dumfries & Galloway	128	£107,627	£144,982	£37,355
Dundee City	124	£105,446	£142,044	£36,598
East Ayrshire	104	£87,265	£117,553	£30,288
East Dunbartonshire	90	£78,539	£105,798	£27,259
East Lothian	83	£65,449	£88,165	£22,716
East Renfrewshire	77	£64,722	£87,185	£22,464
Edinburgh, City of	412	£326,518	£439,845	£113,327
Eilean Siar	23	£18,907	£25,470	£6,562
Falkirk	132	£105,446	£142,044	£36,598
Fife	313	£254,524	£342,864	£88,340
Glasgow City	507	£421,055	£567,195	£146,139
Highland	190	£151,987	£204,739	£52,752
Inverclyde	69	£61,086	£82,287	£21,202
Midlothian	70	£58,904	£79,348	£20,444
Moray	76	£63,267	£85,226	£21,959
North Ayrshire	117	£98,901	£133,227	£34,326
North Lanarkshire	281	£233,435	£314,455	£81,020
Orkney Islands	17	£13,817	£18,613	£4,796
Perth & Kinross	126	£98,173	£132,247	£34,074

Country/Local subgroup	Total number of aphasia patients	Total cost	Total benefit	Total net benefit
Renfrewshire	147	£125,808	£169,473	£43,665
Scottish Borders	97	£77,812	£104,818	£27,007
Shetland Islands	19	£15,999	£21,551	£5,553
South Ayrshire	96	£81,448	£109,716	£28,269
South Lanarkshire	268	£219,618	£295,842	£76,225
Stirling	77	£62,540	£84,247	£21,706
West Dunbartonshire	78	£67,631	£91,104	£23,473
West Lothian	148	£115,627	£155,758	£40,132

Country/Local subgroup	Total number of aphasia patients	Total cost	Total benefit	Total net benefit
Northern Ireland (by Local Commissioning Boards)	1,527	£1,287,809	£1,734,781	£446,971
Belfast LCG	288	£243,166	£327,563	£84,398
Northern LCG	390	£328,966	£443,144	£114,177
South Eastern LCG	292	£246,373	£331,883	£85,511
Southern LCG	301	£253,536	£341,533	£87,997
Western LCG	256	£215,769	£290,657	£74,889

Table A3.3. Local level analysis of the impact of SLT in children with SLI (£ in 2009 prices based on: unit benefit, £4,334; unit cost, £674; unit net benefit, £3,660)

Country/Local subgroup	Total number of children with SLI	Total Cost	Total Benefit	Total Net Benefit
Total Population: England, Wales, NI, Scotland	202,663	£136,607,821	£878,395,193	£741,787,371
England (by Strategic Health Authority)	170,327	£114,811,012	£738,240,607	£623,429,595
North East	8,119	£5,472,432	£35,188,015	£29,715,583
North West	22,996	£15,500,639	£99,669,890	£84,169,251
Yorkshire and the Humber	17,073	£11,508,393	£73,999,548	£62,491,155
East Midlands	14,276	£9,623,223	£61,877,809	£52,254,586
West Midlands	18,605	£12,540,926	£80,638,788	£68,097,862
East of England	19,263	£12,984,456	£83,490,707	£70,506,251
London	25,151	£16,953,273	£109,010,400	£92,057,127
South East Coast	14,510	£9,780,334	£62,888,040	£53,107,706
South Central	13,850	£9,336,049	£60,031,269	£50,695,220
South West	16,484	£11,111,288	£71,446,140	£60,334,853

Country/Local subgroup	Total number of children with SLI	Total Cost	Total Benefit	Total Net Benefit
Wales (by Unitary Local Authority)	9,874	£6,655,999	£42,798,412	£36,142,413
Monmouthshire	308	£207,623	£1,335,024	£1,127,401
Gwynedd	400	£269,602	£1,733,553	£1,463,951
Pembrokeshire	385	£259,439	£1,668,204	£1,408,765
Ceredigion	267	£179,807	£1,156,169	£976,362
Neath Port Talbot	417	£280,833	£1,805,772	£1,524,939
Swansea	720	£485,179	£3,119,726	£2,634,547
Conwy	338	£227,627	£1,463,652	£1,236,025
Cardiff	1,029	£693,391	£4,458,540	£3,765,149
Rhondda Cynon Taff	789	£531,754	£3,419,205	£2,887,451
Anglesey	206	£138,870	£892,941	£754,071
Caerphilly	623	£420,277	£2,702,401	£2,282,124
Bridgend	498	£335,465	£2,157,055	£1,821,590
Wrexham	458	£308,873	£1,986,071	£1,677,198
Flintshire	488	£328,677	£2,113,411	£1,784,734
Vale of Glamorgan	424	£285,652	£1,836,754	£1,551,103
Carmarthenshire	562	£379,157	£2,437,999	£2,058,842
Merthyr Tydfil	182	£122,479	£787,545	£665,066
Newport	488	£329,136	£2,116,362	£1,787,226
Denbighshire	327	£220,174	£1,415,729	£1,195,555
Blaenau Gwent	234	£157,928	£1,015,482	£857,555
Torfaen	301	£202,971	£1,305,112	£1,102,141
Powys	432	£291,087	£1,871,706	£1,580,619

Country/Local subgroup	Total number of children with SLI	Total Cost	Total Benefit	Total Net Benefit
Scotland (by Local Authority)	15,845	£10,680,511	£68,676,228	£57,995,717
Aberdeen City	582	£392,106	£2,521,264	£2,129,158
Aberdeenshire	807	£544,267	£3,499,665	£2,955,398
Angus	340	£229,412	£1,475,128	£1,245,716
Argyll & Bute	254	£170,888	£1,098,820	£927,931
Clackmannanshire	165	£111,194	£714,985	£603,791
Dumfries & Galloway	432	£291,446	£1,874,014	£1,582,568
Dundee City	413	£278,571	£1,791,227	£1,512,655
East Ayrshire	370	£249,309	£1,603,073	£1,353,763
East Dunbartonshire	328	£221,218	£1,422,445	£1,201,226
East Lothian	326	£220,048	£1,414,918	£1,194,871
East Renfrewshire	309	£208,343	£1,339,657	£1,131,314
Edinburgh, City of	1,238	£834,543	£5,366,154	£4,531,611
Eilean Siar	78	£52,671	£338,677	£286,006
Falkirk	490	£330,072	£2,122,378	£1,792,306
Fife	1,127	£759,633	£4,884,479	£4,124,846
Glasgow City	1,679	£1,131,842	£7,277,799	£6,145,957
Highland	679	£457,653	£2,942,729	£2,485,077
Inverclyde	243	£163,865	£1,053,663	£889,797
Midlothian	269	£181,422	£1,166,555	£985,133
Moray	271	£182,593	£1,174,081	£991,488
North Ayrshire	427	£287,935	£1,851,436	£1,563,501
North Lanarkshire	1,101	£742,076	£4,771,587	£4,029,511
Orkney Islands	61	£40,966	£263,416	£222,449
Perth & Kinross	432	£291,446	£1,874,014	£1,582,568
Renfrewshire	528	£355,822	£2,287,953	£1,932,131

Country/Local subgroup	Total number of children with SLI	Total Cost	Total Benefit	Total Net Benefit
Scottish Borders	346	£232,923	£1,497,706	£1,264,783
Shetland Islands	75	£50,330	£323,625	£273,295
South Ayrshire	316	£213,025	£1,369,761	£1,156,736
South Lanarkshire	988	£665,996	£4,282,386	£3,616,390
Stirling	281	£189,616	£1,219,238	£1,029,623
West Dunbartonshire	283	£190,786	£1,226,764	£1,035,978
West Lothian	606	£408,493	£2,626,631	£2,218,138

Country/Local subgroup	Total number of children with SLI	Total Cost	Total Benefit	Total Net Benefit
Northern Ireland (by Local Commissioning Boards)	6,617	£4,460,299	£28,679,946	£24,219,647
Belfast LCG	1,136	£765,497	£4,922,185	£4,156,688
Northern LCG	1,673	£1,128,038	£7,253,339	£6,125,301
South Eastern LCG	1,238	£834,637	£5,366,756	£4,532,119
Southern LCG	1,392	£938,434	£6,034,176	£5,095,742
Western LCG	1,177	£793,694	£5,103,490	£4,309,797

Table A3.3. Local level analysis of the impact of SLT in children with autism (£ in 2009 prices based on: unit benefit, £3,552; unit cost, £2,430; unit net benefit, £1,122)

Country/Local subgroup	Total number of children with autism	Total cost	Total benefit	Total net benefit
Total Population: England, Wales, NI, Scotland	8,763	£21,295,114	£31,128,520	£9,833,406
England (by Strategic Health Authority)	7,376	£17,924,119	£26,200,907	£8,276,788
North East	342	£831,392	£1,215,302	£383,910
North West	983	£2,389,319	£3,492,630	£1,103,311
Yorkshire and the Humber	733	£1,781,824	£2,604,614	£822,790
East Midlands	597	£1,450,966	£2,120,976	£670,010
West Midlands	797	£1,936,069	£2,830,084	£894,015
East of England	806	£1,958,674	£2,863,127	£904,453
London	1,276	£3,101,541	£4,533,734	£1,432,193
South East Coast	594	£1,443,543	£2,110,125	£666,582
South Central	585	£1,422,523	£2,079,398	£656,876
South West	662	£1,608,269	£2,350,917	£742,648

Country/Local subgroup	Total number of children with autism	Total cost	Total benefit	Total net benefit
Wales (by Unitary Local Authority)	399	£968,607	£1,415,879	£447,272
Monmouthshire	12	£28,786	£42,078	£13,292
Gwynedd	15	£37,019	£54,114	£17,094
Pembrokeshire	14	£35,175	£51,418	£16,243
Ceredigion	10	£23,330	£34,103	£10,773
Neath Port Talbot	18	£42,728	£62,458	£19,730
Swansea	30	£73,368	£107,248	£33,879
Conwy	13	£31,595	£46,185	£14,590
Cardiff	46	£112,753	£164,818	£52,066
Rhondda Cynon Taff	33	£79,856	£116,731	£36,875
Anglesey	8	£19,729	£28,839	£9,110
Caerphilly	25	£60,944	£89,086	£28,142
Bridgend	20	£49,037	£71,680	£22,644
Wrexham	20	£47,568	£69,534	£21,965
Flintshire	19	£46,712	£68,282	£21,570
Vale of Glamorgan	16	£39,015	£57,031	£18,016
Carmarthenshire	22	£52,902	£77,331	£24,429
Merthyr Tydfil	8	£19,078	£27,888	£8,810
Newport	19	£46,968	£68,657	£21,689
Denbighshire	12	£29,969	£43,808	£13,839
Blaenau Gwent	9	£22,333	£32,646	£10,313
Torfaen	13	£31,083	£45,435	£14,353
Powys	16	£38,657	£56,508	£17,851
Scotland (by Local Authority)	697	£1,694,674	£2,477,221	£782,547

Country/Local subgroup	Total number of children with autism	Total cost	Total benefit	Total net benefit
Aberdeen City	26	£62,215	£90,945	£28,729
Aberdeenshire	36	£86,359	£126,236	£39,878
Angus	15	£36,401	£53,209	£16,809
Argyll & Bute	11	£27,115	£39,636	£12,521
Clackmannanshire	7	£17,643	£25,790	£8,147
Dumfries & Galloway	19	£46,244	£67,598	£21,354
Dundee City	18	£44,201	£64,611	£20,411
East Ayrshire	16	£39,558	£57,824	£18,267
East Dunbartonshire	14	£35,101	£51,309	£16,208
East Lothian	14	£34,915	£51,038	£16,123
East Renfrewshire	14	£33,058	£48,323	£15,265
Edinburgh, City of	54	£132,417	£193,563	£61,146
Eilean Siar	3	£8,357	£12,216	£3,859
Falkirk	22	£52,372	£76,556	£24,184
Fife	50	£120,531	£176,188	£55,657
Glasgow City	74	£179,589	£262,518	£82,928
Highland	30	£72,616	£106,147	£33,532
Inverclyde	11	£26,000	£38,007	£12,006
Midlothian	12	£28,786	£42,079	£13,293
Moray	12	£28,972	£42,350	£13,378
North Ayrshire	19	£45,687	£66,783	£21,097
North Lanarkshire	48	£117,745	£172,116	£54,371
Orkney Islands	3	£6,500	£9,502	£3,002
Perth & Kinross	19	£46,244	£67,598	£21,354

Country/Local subgroup	Total number of children with autism	Total cost	Total benefit	Total net benefit
Renfrewshire	23	£56,458	£82,529	£26,071
Scottish Borders	15	£36,958	£54,024	£17,066
Shetland Islands	3	£7,986	£11,673	£3,688
South Ayrshire	14	£33,801	£49,409	£15,608
South Lanarkshire	43	£105,673	£154,470	£48,797
Stirling	12	£30,086	£43,979	£13,893
West Dunbartonshire	12	£30,272	£44,251	£13,979
West Lothian	27	£64,815	£94,745	£29,930

Country/Local subgroup	Total number of children with autism	Total cost	Total benefit	Total net benefit
Northern Ireland (by Local Commissioning Boards)	291	£707,714	£1,034,514	£326,800
Belfast LCG	50	£121,461	£177,548	£56,087
Northern LCG	74	£178,985	£261,635	£82,650
South Eastern LCG	54	£132,432	£193,584	£61,153
Southern LCG	61	£148,901	£217,659	£68,758
Western LCG	52	£125,935	£184,088	£58,153