NHS
Institute for Innovation and Improvement

An economic evaluation of alternatives to antipsychotic drugs for individuals living with dementia

October 2011

matrix evidence

Foreword

‘As the number of people living with dementia increases it becomes ever more important to ensure that they, and their carers, are given the opportunity to live well with dementia, and be able to access treatments and interventions which improve quality of life..
This carefully considered cost benefit analysis illustrates how much more effective it can be to support people with dementia who experience behavioural and psychological symptoms with interventions other than antipsychotics, which we know have the potential to cause harm.
The report shows very well the multifaceted and bi-directional relationship between cost and quality of care, and outcomes and quality of life.
We must demonstrate that we are responsible stewards of the resources available to us and at the same time ensure that we do no harm and improve the quality of life for those in our care. This report shows how this is possible.’

Professor Alistair Burns
National Clinical Director for Dementia

Dr Nadia Chambers OBE
Lead Associate
NHS Institute for Innovation and Improvement

List of abbreviations

BPSD Behavioural and psychological symptoms of dementia

CBA Cost-benefit analysis

QALY Quality Adjusted Life Year

This study was commissioned by South Tees Hospitals Foundation Trust and undertaken by Matrix Evidence.
This report was written by Matrix Evidence.

Contents

1.0 Executive Summary

The objective of this research was to generate economic evidence of the benefits of behavioural alternatives to antipsychotic drug use for individuals living with dementia. NICE guidelines recommend that the first line of treatment for behavioural and psychological symptoms among those with dementia should be psychosocial interventions. However, in practice antipsychotic drugs are used as the first line of treatment. In line with NICE guidelines, this report suggests that behavioural interventions are a more efficient use of public money than antipsychotic drugs.

It is estimated that behavioural interventions cost £27.6 million more per year than antipsychotic drugs for the cohort of 133,713 individuals with dementia requiring antipsychotic drugs in England. However, the additional investment is offset by nearly £70.4 million in health care savings due to reduced incidence of strokes and falls. Specifically, behavioural interventions would avoid nearly 1,348 cases of stroke and 118 falls compared to antipsychotic drugs per year. Of these health care cost savings, £4.7 million were estimated to be realisable as they are due to medication costs.

Therefore some of the extra cost of behavioural interventions is paid for through financial savings as a result of avoided strokes and falls. The majority of the value of behavioural interventions, however, comes through saving time and other resources that will increase the capacity of the health service.

In addition to the health care cost savings, behavioural interventions generate quality of life improvements. If these quality of life improvements are valued monetarily at the lower end of the NICE threshold, behavioural interventions would generate an additional £12.0 million in benefits per annum.

Combining health care cost savings and quality of life improvements, behavioural interventions generate a net benefit of nearly £54.9 million per year. This net benefit ranges from nearly £2.8 million per year in North East SHA to £7.3 million per year in North West SHA.

As there are a broad range of behavioural interventions available, this analysis focused on the cost of providing cognitive stimulation therapy (Spector 2003). However, the sensitivity analysis suggests that this conclusion may extend to other forms of behavioural interventions.

There were a number of limitations in the analysis due to the availability of data. Therefore, sensitivity analysis was conducted on key uncertain variables. The results of sensitivity analysis suggest that the conclusion that the behavioural interventions represent an efficient use of public resources is unlikely to change.

A number of benefits associated with behavioural interventions have not been included in the model. For example, evidence suggests that behavioural interventions are associated with reduced incidence of gait disturbance and mortality (Banerjee 2009). Limiting the scope of the research only to stroke and falls implies that the analysis underestimates the total benefit of behavioural interventions.

2.0 Introduction

There are approximately 750,000 elderly patients, aged 65 and older, currently living with dementia in the UK. A majority of individuals with dementia will experience behavioural and psychological symptoms (BPSD) at some point during their illness. The most common BPSD include - psychosis, agitation, aggression, wandering, shouting, repeated questioning and sleep disturbance (Banerjee, 2009).

NICE guidelines recommend that the first line of treatment for BPSD should be psychosocial interventions (NICE, 2007). However, in practice, antipsychotic drugs are used as the first line of treatment. It is estimated that nearly £80 million per year is spent on antipsychotic drugs specifically for individuals living with dementia. However, the evidence suggests these drugs are limited in their effectiveness (Banerjee, 2009). In addition, antipsychotics have a considerable risk of side effects such as – stroke, falls, gait disturbance, and death. For example, Banerjee (2009) estimated that when treating 1,000 individuals with dementia with BPSD for around 12 weeks would result in an additional 18 strokes, 10 deaths, and nearly 70 cases of gait disturbance.

In accordance with NICE guidelines, an alternative to antipsychotic drugs are behavioural interventions. Behavioural interventions attempt to treat the BPSD without the use of pharmaceuticals. Behavioural interventions can vary in nature but typically involve helping those with dementia manage their condition through some form of structured activity. Common behavioural interventions include – re-orientation therapy, cognitive stimulation, music therapy, and sensory stimulation. The evidence suggests these types of interventions are successful in the management of BPSD (Livingston, 2005 and Cohen Mansfield, 2003). In addition, behavioural interventions are not associated with any significant side effects.

Regardless of the evidence around the limited effectiveness of antipsychotic drugs and their considerable side effects, in practice antipsychotic drugs are used significantly more often than behavioural interventions to treat individuals living with dementia.

In this context, Matrix Evidence was commissioned to undertake research into the economic case of providing behavioural interventions as an alternative to antipsychotics drug use. The economic value of providing behavioural interventions was assessed by undertaking a cost-benefit analysis (CBA). The CBA compared the cost of providing the intervention with their benefits in terms of cost savings and quality of life improvement associated with reduced incidence of stroke and falls. These two outcomes were selected due to the availability of the evidence.

The next section summarises the method employed in the research. Section 4 presents the results and the last section discusses the implications of the research.

3.0 Methodological Approach

3.1 Overview of the analysis

A CBA compares the costs and effects of an intervention, all expressed in monetary terms. Therefore, the CBAs were built upon the following three elements:

- The ***cost*** of the resources required to deliver the interventions.
- The ***effects*** of the interventions on incidence of stroke and falls, expressed in natural units.
- The ***benefits*** of the interventions –i.e. the monetary value of the effects generated by the interventions.

Following best practice, decision models were built to assess the costs and benefits of the intervention. A separate decision model was built for each outcome. The structure of the decision models used are presented in Appendix 1.

Estimates of the following costs and benefits were included in the models:

- ***Costs***. The analysis considered the estimated annual cost of delivering each intervention – antipsychotic drug use and behavioural.
- ***Effects***. The models considered the effect of behavioural interventions in terms of reduced incidence of stroke and falls relative to antipsychotic drugs. .
- ***Benefits***. The benefits of a reduced incidence of stroke and falls are estimated in terms of health 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:

- ***Literature review***. A brief literature review was conducted to identify data on antipsychotic drugs and behavioural interventions. The literature review included data identified and provided by NHS Institute for Innovation and Improvement, and National Taskforce. The literature review identified data on:
    - Probability that individuals living with dementia experience a stroke when receiving antipsychotic drugs in comparison to no use
    - Probability that individuals living with dementia experience a fall when receiving antipsychotic drugs in comparison to no use
    - The cost of delivering a behavioural intervention
    - The cost per stroke
    - The cost per fall
    - QALY[1] gain due to an avoided stroke
    - QALY gain due to an avoided fall

[1] The 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 allows these effects to be expressed as monetary values.

- ***Expert opinion***. Ten experts indentified by the NHS Institute for Innovation and Improvement were asked to take part in an interview. Due to the short time frame of the analysis, only one expert was able to take part in the analysis. The expert was asked to provide data on the effect of antipsychotic drugs on falls in elderly, and the cost of behavioural interventions.

3.3 Models and presentation of results

The models were estimated assuming that the interventions are run for one year. All monetary figures are in 2010 prices.

Inevitably, the parameters required to populate the models are subject to uncertainty. To assess the impact of this uncertainty, the models were put through a series of iterations to examine the effect of variations in key parameters on the net benefits.

Three indicators are used to synthesise the results of the CBAs:

- The ***net benefit***, which is calculated as the difference between the benefits and the costs. Values higher than zero indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources.
- The ***benefit-cost ratio***, which is calculated as the ratio of benefits to costs. Values higher than one indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources.
- The ***realisable savings***, which is the proportion of the benefit which can be realised as cash savings - which is calculated as the percentage of treatment costs which is due to medications multiplied by the total treatment costs.

4.0 Results

Key messages

In England, the annual benefits generated by using behavioural interventions as an alternative to antipsychotic drug use for dementia patients exceed the annual cost of the therapy by £54.9 million. Behavioural interventions provide good value for money.

The behavioural intervention chosen for this analysis is cognitive stimulation therapy. It is estimated the behavioural intervention will cost nearly £27.6 million more than antipsychotic drug use. However, the behavioural interventions will generate nearly £70.4 million in health care cost savings due to reduced incidence of stroke and falls. Therefore, the health care cost savings outweigh the increased cost of the intervention making behavioural interventions an efficient use of public money.

An estimated £4.7 million of the health care cost savings are considered to be realisable as they are due to medication costs. In addition to health care cost savings, behavioural interventions generate nearly £12 million due to quality of life improvements due to reduced incidence of stroke and falls.

These savings are based on a total population of 133,713 dementia patients currently using antipsychotic drugs in England.

When examining the net benefit by strategic health authority the net benefit varies from £2.8 million in North East to £7.3 million in North West.

Summary of findings

Table 2 summarises the findings from the CBA for a cohort of 133,713 individuals living with dementia with severe BPSD symptoms requiring antipsychotic drugs. Annual costs and monetary benefits in both scenarios, antipsychotic drug use and behavioural interventions, are presented separately. The differences represent the incremental costs and monetary benefits attributable to behavioural interventions.

It is evident from Table 2 that the use of behavioural interventions provides good value for money. Behavioural interventions cost nearly £27.6 million more than antipsychotic drug use, however they generate a benefit of nearly £82.4 million. Nearly 85 per cent of the total benefit is due to stroke treatment costs. It is estimated that the behavioural interventions will prevent nearly 1,338 cases of stroke. The second largest benefit is due to the monetary value associated with quality of life improvements, which is nearly 15 per cent of total benefits. The benefit associated with fall treatment costs is only 0.3 per cent of the total benefit. In addition, 6 per cent of the total benefit is realisable; as these costs are associated with medications.

In addition, the analysis demonstrates that every £1 investment in behavioural interventions will generate £1.99 in health care cost savings and quality of life gains.

Table 2. Annual costs and benefits of behavioural interventions for individuals living with dementia in England (£ in 2010 prices)

Parameter	Antipsychotic drug use	Behavioural interventions	Difference
Total cost of intervention			
Total	£67,000,000	£94,560,304	-£27,560,304
Strokes			
Total number of strokes	2,541	1,203	
Total cost of stroke treatment	£133,304,032	£63,144,015	£70,160,017
Falls			
Total number of falls	3,256	3,138	
Total cost of fall treatment	£7,373,508	£7,105,728	£267,780
QALY			
Net QALY gain from strokes			591
Net QALY gain from falls			12
Total QALY gain			603
Total monetary value of QALY gain			£12,059,258
Net benefit			£54,926,751
Benefit to cost ratio*			1.99
Realisable savings			£4,656,985

***** *Values higher than one indicate that the benefits exceed the costs, and thus the intervention represents an efficient use of public resources.*

Detailed calculation on how the numbers presented above are generated can found in the Appendix 1.

Throughput

- Incidence of dementia ranges from 1.5 per cent in those aged 65-69 to 23 per cent to those aged > 85 (Dementia UK 2010, NHS Information Centre 2008).
- Local level population estimates from England, were aggregated resulting in a total population of 51.2 million. Applying the incidence of dementia to the total population, the estimated population individuals living with dementia is 670,000.
- 20 per cent of individuals living with dementia require antipsychotic drugs (NPC, 2009).
- Applying the percentage of individuals living with dementia requiring antipsychotic drugs, the estimated population of individuals living with dementia requiring antipsychotic drugs is 133,700.

Costs

- The total expenditure on antipsychotic drugs in the UK is £80 million (Banerjee 2009). Adjusting the total UK expenditure to the population in England, the estimated total cost of antipsychotic drug use is £67 million (NHS Information Centre 2008).
- Dividing the total expenditure by the number of individuals living with dementia requiring antipsychotic drugs outlined above, the estimated cost per individual living dementia using antipsychotic drugs is £500.
- It is estimated that the cost per individual using a behavioural intervention is £707. The behavioural intervention is based on an individual living with dementia attending a group cognitive stimulation session 7 times per week for one year with each session lasting 45 minutes. Each group has on average 12 members. Therefore, each individual receives to 22.8 hours of therapy per year. A cost of £31 per hour with a NHS community mental health team (CMHT) worker for older people (OP) with mental health problems was used to arrive at this estimate. (Matrix based on PSSRU, 2010, and Spector 2003).

Effect on stroke and falls

- The probability an individual living with dementia experiences a stroke when not using antipsychotic drugs is 0.9 per cent, in comparison to 1.9 per cent when using an antipsychotic drug (Schneider et al 2006). Schneider et al 2006 was chosen as the source for this evidence as it had the highest quality evidence of the literature identified. Other effect studies which were identified through the literature search can be found in Appendix 2.
- The probability an individual living with dementia experiences a fall when not using antipsychotic drugs is 2.3 per cent, in comparison to 2.4 per cent when using an antipsychotic drug (Ray 1997, Landi 2005, and Hien 2005).

Monetary benefits

- A stroke requiring hospital treatment costs £52,471 (Saka, 2009, and Stroke Association, 2010).
- It is estimated that 7 per cent of stroke treatment costs are realisable as they are attributable to outpatient drug costs. (Saka, 2009)[2]
- A fall requiring hospital treatment costs £2,265 (Scuffham and Chaplin, 2003).
- The percentage of fall treatment costs which are realisable could not be determined. Therefore, the same percentage of stroke treatment costs which are realisable are applied to fall treatment costs.
- The incremental QALY gain per avoided stroke is 0.20 (McMahon 2003, and Tammy 2001).
- The incremental QALY gain per avoided fall is 0.09 (McMahon 2003, and NICE 2004).
- It is estimated the value of the QALY gain generated by behavioural interventions compared to antipsychotic drug use associated with reduced incidence of stroke and falls amounts to £12.1 million[3].

Local level analysis

[2] Saka (2009) does not provide details on specifically which drugs are used or how long they were taken. The paper only provides an overall annual estimate of stroke treatment costs which are due to outpatient drugs.

[3] The QALYs gained were valued at £20,000 per QALY, the lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Clinical Excellence (NICE) and commonly used in economic evaluations valuing health outcomes.

Table 3 presents the result for the CBA disaggregated by strategic health authority. It is evident from Table 3 that the net benefit ranges from £3.0 million in North East to £7.8 million in North West. The net benefit is directly related to the population size of each health authority.

Table 3. Annual costs and benefits of behavioural interventions by SHA (£ in 2010 prices)

SHA	Individuals living with dementia	Increased cost of behavioural intervention	Benefit due to stroke treatment	Benefit due to fall treatment	Benefit due to QALY gain	Total net Benefit	Net Benefit realisable
North East	6,766	-£1,394,497	£3,549,960	£13,549	£610,175	£2,779,186	£235,634
North West	17,692	-£3,646,513	£9,282,896	£35,430	£1,595,565	£7,267,377	£616,167
Yorkshire and the Humber	13,359	-£2,753,558	£7,009,707	£26,754	£1,204,844	£5,487,747	£465,281
East Midlands	11,448	-£2,359,564	£6,006,721	£22,926	£1,032,448	£4,702,531	£398,706
West Midlands	14,237	-£2,934,403	£7,470,082	£28,511	£1,283,974	£5,848,165	£495,839
East of England	15,709	-£3,237,833	£8,242,522	£31,459	£1,416,743	£6,452,891	£547,111
London	14,489	-£2,986,391	£7,602,428	£29,016	£1,306,722	£5,951,775	£504,623
South East Coast	13,120	-£2,704,303	£6,884,321	£26,275	£1,183,292	£5,389,585	£456,958
South Central	10,304	-£2,123,797	£5,406,531	£20,635	£929,286	£4,232,656	£358,867
South West	16,590	-£3,419,445	£8,704,849	£33,224	£1,496,209	£6,814,837	£577,798
Total	133,713	-£27,560,304	£70,160,017	£267,780	£12,059,258	£54,926,751	£4,656,985

Sensitivity analysis

A few parameters used in the model are subject to uncertainty. Therefore, additional analysis was undertaken to observe the sensitivity of the net benefit to changes in the cost of the behavioural intervention, probability of stroke with antipsychotic drugs, probability of falling without antipsychotic drugs, and the cost of antipsychotic drugs per year in England. 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 the net benefit.

Table 4. Sensitivity analysis

Parameter	Value in model	Sensitivity analysis range

		Low	High
Cost of behavioural intervention per year per individual living with dementia	£707	£200	£1,200
Probability of stroke with antipsychotic drugs	.019	.010	.019
Probability of falling with antipsychotic drugs	.024	.023	.036
Cost of antipsychotic drugs for individuals with dementia per year in England	£67 million	£60 million	£120 million

Figure 1 shows the relationship between the total net benefit and the cost of the behavioural intervention per individual living with dementia. It demonstrates that, holding all other parameters constant, the net benefit remains positive as long as the cost of the behavioural intervention per person per year is below £1,118.

The behavioural intervention chosen for the analysis was based on a study which provided daily cognitive stimulation therapy to a group of individuals living with dementia over 7 weeks. For the purpose of the economic model, the cost of the intervention was extrapolated to an annual figure. However, as the therapy is very intensive it can be assumed that in practice a behavioural intervention will be much less frequent and therefore cost significantly less. The sensitivity analysis shows that even when a highly intensive intervention is introduced behavioural interventions still produce a positive net benefit.

Figure 1. Sensitivity of net benefit to cost of behavioural intervention per individual living with dementia

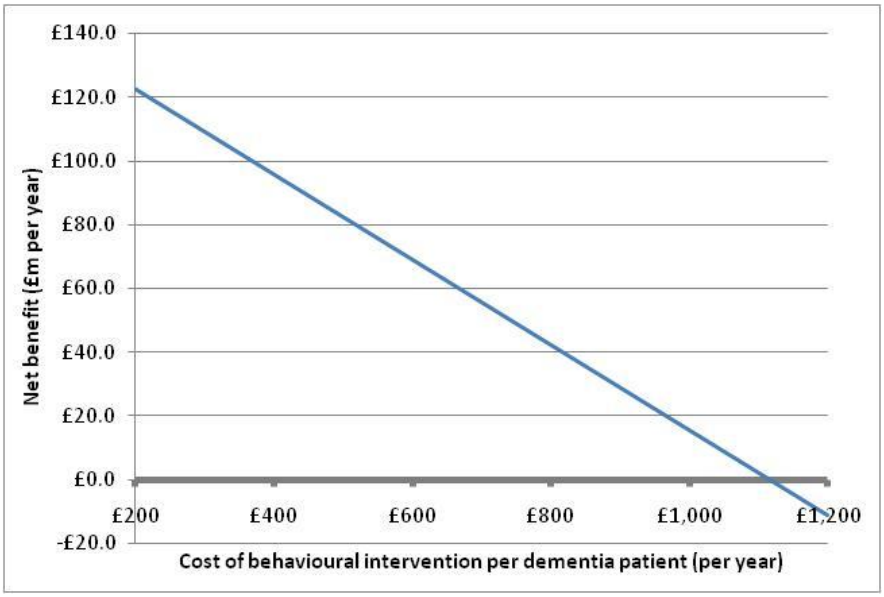


Figure 2 shows the relationship between the total net benefit and the probability an individual living with dementia has a stroke when using antipsychotic drugs. It demonstrates that, holding all other parameters constant, the net benefit remains positive as long the probability an individual living with dementia experiences a stroke is above 1.2 per cent. The value used

within the model is taken from a high quality meta-analysis and is considerably higher than the minimum percentage required for the benefit to be positive.

Figure 2. Sensitivity of net benefit to the probability of stroke when using antipsychotic drugs.

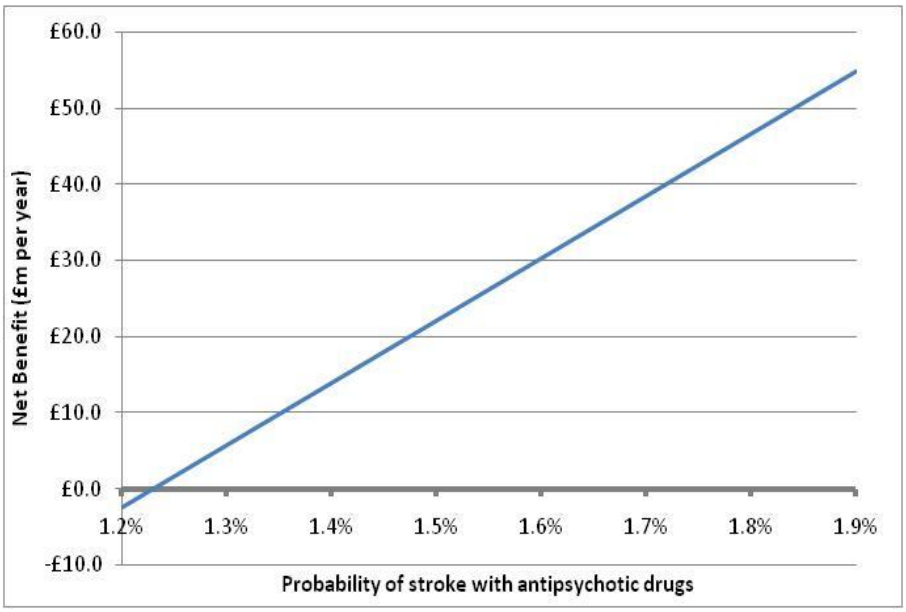


Figure 3 shows the relationship between the total net benefit and the probability an individual with dementia falling when using antipsychotic drugs. It demonstrates that, holding all other parameters constant, the net benefit is not sensitive to the probability of an individual with dementia falling. For example, even when the probability of falling with antipsychotic drugs is equivalent to probability of falling without antipsychotic drugs (i.e. 2.3 per cent) behavioural interventions still produce a positive net benefit of about £54 million. As the cost per fall is not significant relative the cost per stroke, the benefit gained due to reducing falls is minimal.

However, evidence does suggest that regardless of using antipsychotic drugs behavioural interventions reduce the baseline risk of falling in elderly due to the nature of the intervention (Gillespie, et al 2009). If this is the case, the sensitivity analysis shows that the net benefit can be expected to increase.

Figure 3. Sensitivity of net benefit to probability of falling when using antipsychotic drugs

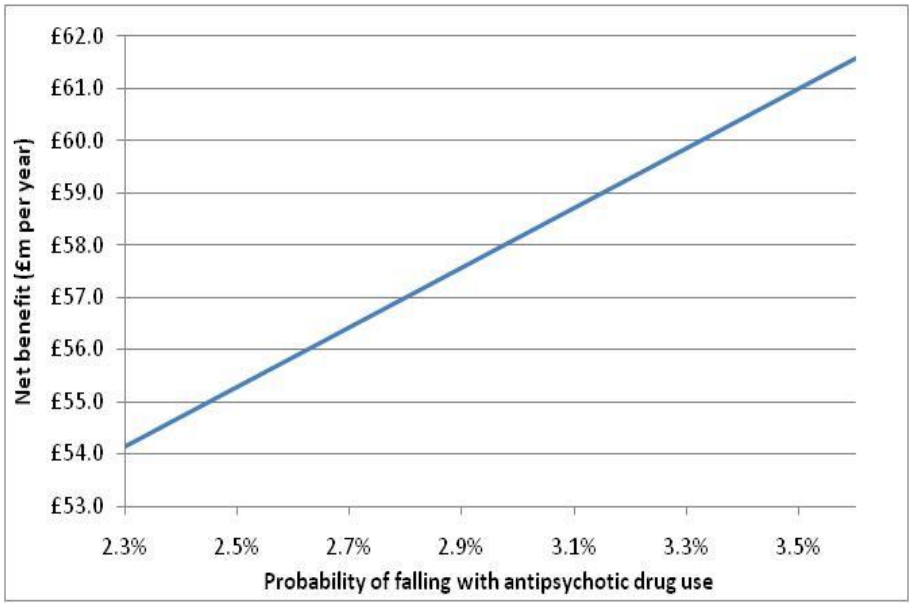
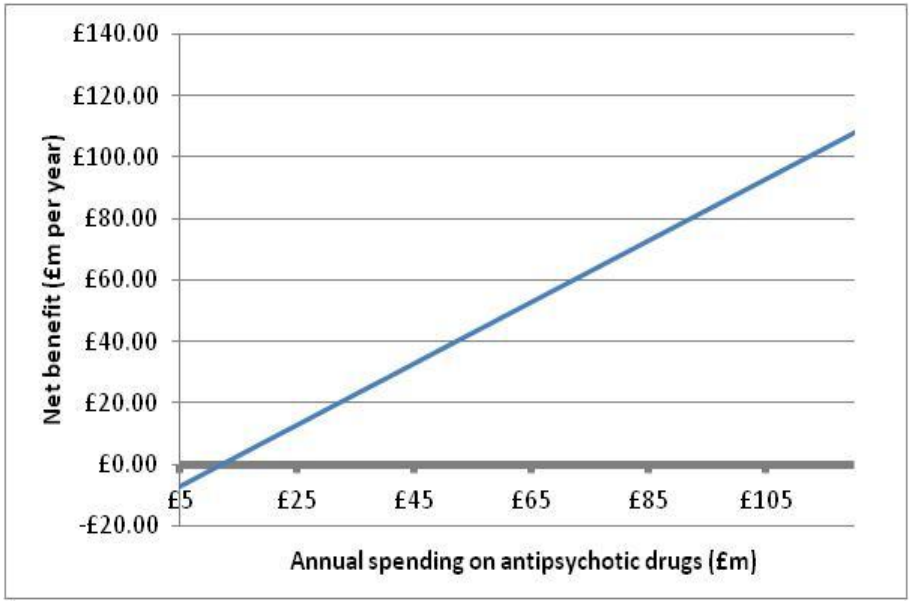


Figure 4 shows the relationship between the total net benefit and the annual cost of antipsychotic drugs for individuals with dementia in England. It demonstrates that, holding all other parameters constant, the net benefit remains positive as long as annual spending is above nearly £12 million. The value used within is based on adjusting the estimated total annual spending on antipsychotic drugs for individuals living with dementia in the UK reported by Banerjee 2009. The sensitivity analysis shows that even when the annual spending is greatly reduced the analysis generates positive net benefits.

Figure 4. Sensitivity of net benefit to annual spending on antipsychotic drugs for individuals living with dementia



Key assumptions

In defining the structure of the model and populating it, a number of key assumptions were made:

- The behavioural intervention chosen for the analysis was a cognitive stimulation therapy. There are a number of different forms of behavioural interventions which can be used for individuals living with dementia. The cost of the behavioural intervention is tested in the sensitivity analysis.
- The literature search only identified papers which examined the relative increase in risk of all falls in elderly patients due to antipsychotic drugs. However, all falls do not result in treatment costs. Therefore assumptions were made in order to estimate the increased likelihood of falls requiring treatment due to antipsychotic drugs. Detailed calculations can be found in Appendix Table A1.2.
- The benefit of a reduced incidence of stroke was measured in terms of treatment costs per stroke. To calculate the health costs associated with a stroke it was assumed that strokes experienced by individuals living with dementia are similar to strokes experienced by the general population.
- Data from Saka 2009 provided the percentage of stroke treatment costs which are realisable. However, similar data was not found for the fall treatment costs. Therefore it was assumed the percentage of stroke treatment costs which are realisable is the same for fall treatment costs. However, fall treatment costs are a small proportion of the total costs – therefore this assumption does not impact the results of the analysis significantly.

5.0 Discussion

The results of the CBAs are summarised in Table 5. This indicates that behavioural interventions represent an efficient alternative to antipsychotic drug use in England. Specifically, every £1 invested in behavioural interventions would generate almost £2 in benefits, and if behavioural interventions were implemented across England they would generate a net gain of £55m.

If the results of the analysis were to be interpreted using a cost per QALY ratio as used in NICE appraisals, behavioural interventions have a cost per QALY of -(£71,095). The negative ICER refers to the fact that the behavioural intervention reduces costs and increases QALY's. In comparison, a cost-effectiveness analysis of cognitive enhancers to treat individuals living with Alzheimer's predicts cost per QALY ratios of nearly £80,000, £57,000, £68,000, and £44,000 for Donepezil, Rivastigmine, Galantamine, and Memantine respectively (Loveman et al 2006). The use of these pharmaceuticals may improve quality of life but come at a significant increase in costs, whereas behavioural interventions improve quality of life while also reducing health care costs.

Table 5. Annual net benefits and benefit-cost ratios of behavioural interventions as an alternative to antipsychotic drug use for individuals living with dementia (£m in 2010 prices)

Parameter	Value
Increased cost of behavioural intervention relative to antipsychotic drug use	-£27.6
Incremental benefit due to reduced stroke treatment costs	£70.2
Incremental benefit due to reduced fall treatment costs	£0.27
Monetary value of QALY gain (strokes)	£11.8
Monetary value of QALY gain (falls)	£0.24
Total monetary value of QALY gain	£12.0
Net benefit	£54.9
Cost to benefit ratio	1.99
Realisable savings	£4.7

In interpreting these results it is important to keep in mind the following limitations of the analysis:

- Currently in the UK, there is not a standard behavioural intervention which is ideal for individuals with dementia. Given the significant variety in types of behavioural interventions, the economic model focused on the cost of one specific type of intervention – cognitive stimulation described by Spector (2003). In order to generalise the results to other types of behavioural interventions the cost of the intervention was tested in the sensitivity analysis. The sensitivity analysis indicated that as long as the behavioural intervention is below £1,118 per person living with dementia per year, the intervention will generate positive net benefits.

- The literature search could not identify any papers which examined the probability of serious falls when individuals living with dementia are using antipsychotic drugs compared to no use. The papers identified only detailed the increased risk of all types of falls – i.e. those which included no treatment and those which include treatment. Therefore assumptions were made to estimate the increased risk of falls which require treatment. These are outlined in Appendix table A1.2. However, the sensitivity analysis indicated that even when there is no increased risk of serious falls, behavioural interventions generate a positive net benefit due to their impact on stroke.
- The proportion of stroke costs which were are considered to be realisable was identified in the literature. However, similar data could not be found for fall treatment costs. Therefore the analysis assumed the percentage of fall treatment costs which are realisable is the same as stroke treatment costs. However, the analysis indicates that the benefit associated with fall treatment costs is relatively small compared to stroke treatment costs. Therefore this assumption will not have a material impact on the results of the analysis.
- The benefits captured in the model are reduced incidence of stroke and falls. There are numerous other benefits associated with using behavioural interventions such as reduced gait disturbance and overall mortality. Limiting the scope of the model to stroke and falls implies that the CBA underestimates the total benefit of behavioural interventions. In addition, the CBA underestimates the total net benefit as the analysis was limited to a one year time horizon. If the analysis was extended to a longer time frame, the total net benefit would be expected to increase.

Even though the above limitations mean that the estimated net benefits are subject to uncertainty, the sensitivity analysis suggested that the conclusion that the behavioural interventions represent an efficient use of public resources is unlikely to change. The results suggest that investment in behavioural interventions as an alternative to antipsychotic drug use has the potential to deliver benefits that greatly exceed the cost.

6.0 References

1. Banerjee S. (2009). The use of antipsychotic medication for people with dementia: Time for action. The Institute of Psychiatry, King's College London.
2. Cohen-Mansfield J. (2004). Nonpharmacologic Interventions for Inappropriate Behaviours in Dementia: A Review, Summary and Critique. The Journal of Lifelong Learning in Psychiatry, 2(2), pp. 288-308.
3. Curtis, L. (2010) *Unit Costs of Health and Social Care 2007.*PSSRU: University of Kent, Canterbury
4. Gillespie LD et al. (2009). Interventions for preventing falls in older people living in the community (Review). The Cochrane Collaboration, 4, published by John Wiley & Sons, Ltd
5. Hien et al (2005) Atypical antipsychotic medications and risk of falls in residents of aged care facilities. JAGS (53) 8. pp.1290-1295.
6. Jeste Vilip D. et al. (2007), ACNP White Paper: Update on Use of Antipsychotic Drugs in the Elderly Persons with Dementia, Journal of Neuropsychopharmacology, pp. 1-14
7. Landi Francesco et al. (2005) Psychotropic Medication and Risk for Falls among Community-Dwelling Frail Older People: An Observational Study. Journal of Gerontology, 60A(5), pp. 622-626
8. Livingston Gill et al. (2005). Systematic Review of Psychological Approaches to the Management of Neuropsychiatric Symptoms of Dementia. Am J Psychiatry, 162(11), pp. 1996-2021
9. Lovemen et al (2006). The clinical and cost effectiveness of donepezil, rivastigmine, galantamine and memantine for Alzheimer's disease. Available: http://www.hta.ac.uk/pdfexecs/summ1001.pdf . Last accessed 23rd September 2011.
10. Luengo-Fernandez, Ramon, Leal, Jose, Gray, Alastair (2010). Dementia 2010 – the economic burden of dementia and associated research funding in the United Kingdom. University of Oxford, pp.1-38.
11. McMahon, Pamela M, Araki, Sally S, Gazelle, G Scott, Neumann, Peter J, Sandberg, Eileen A, Cost-effectiveness of PET in the diagnosis of Alzheimer disease., Radiology,2003-Aug; 228(2):515-22
12. National Prescribing Centre (NPC) (2009). Government takes action on reducing the use of antipsychotic drugs in dementia. [http://www.npc.nhs.uk/rapidreview/?p=847]
13. NHS Information Centre (2008) Attribution Dataset GP Registered Populations. [http://www.ic.nhs.uk/statistics-and-data-collections/population-and-geography/population/attribution-dataset-gp-registered-populations-2008]
14. NICE (2006). Dementia – The NICE-SCIE guideline on supporting people with dementia and their carers in health and social care. The British Psychological Society and Gaskell.
15. Nice Full Guidance (2004). Clinical Practice guideline for the assessments and prevention of falls in older people. Published by the Royal College of Nursing.
16. Ray WA, Taylor JA, Medor KG, Thapa PB, Brown AK, Kajihara HK, Davis C, Gideon P, Griffin MR. A randomized trial of a consultation service to reduce falls in nursing homes. Journal of the American Medical Association 1997;278:557–62.
17. Riefkohl Elsaris et al. (2003). Medications and Falls in the Elderly: A Review of the Evidence and Practical Considerations. 28(11), pp. 724-733
18. Rubenstein LZ, Josephson KR. The epidemiology of falls and syncope. Clin Geriatr Med 2002;18:141–158.

19. Saka O. et al. (2009). Cost of stroke in the United Kingdom. Published by Oxford University Press, 38, pp.27-32
20. Scuffman P., Chaplin S., and Legood R., (2003). Incidence and costs of unintentional falls in older people in the United Kingdom. J Epidemiol Community Health, 57, pp. 740-744
21. Shneider L., et al. (2006). Efficacy and Adverse Effects of Atypical Antipsychotics for Dementia: Meta-Analysis of Randomized, Placebo- Controlled Trials, American Association for Geriatric Psychiatry
22. Spector A. et al. (2003). Efficacy of an evidence-based cognitive stimulation therapy programme for people with dementia. British Journal of Psychiatry, 183, pp.248-254
23. Tammy O. Tengs et al. (2001). Health- Related of life After Stroke a Comprehensive Review. Published by American Heart Association, 32, pp. 964-972
24. The Stroke Association (2011). Facts and Figures about Stroke. Available: http://www.stroke.org.uk/media_centre/facts_and_figures/index.html. Last accessed 19th September 2011.

7.0 Appendix 1: decision model and data tables

Figure A.1 and Figure A.2 presents the decision models for the effect of behavioural interventions as an alternative to antipsychotic drugs for individuals living with dementia experiencing BPSD requiring antipsychotic drugs. Table A.1 and A.2 summarise the data used to populate the model.

It should be noted that though the model for stroke and falls was constructed separately the results are reported in combination. Therefore, the cost of the behavioural intervention and antipsychotic intervention is compared against the total combined benefit of strokes and falls.

Figure A.1. A decision model for providing behavioural interventions as an alternative to antipsychotics - stroke

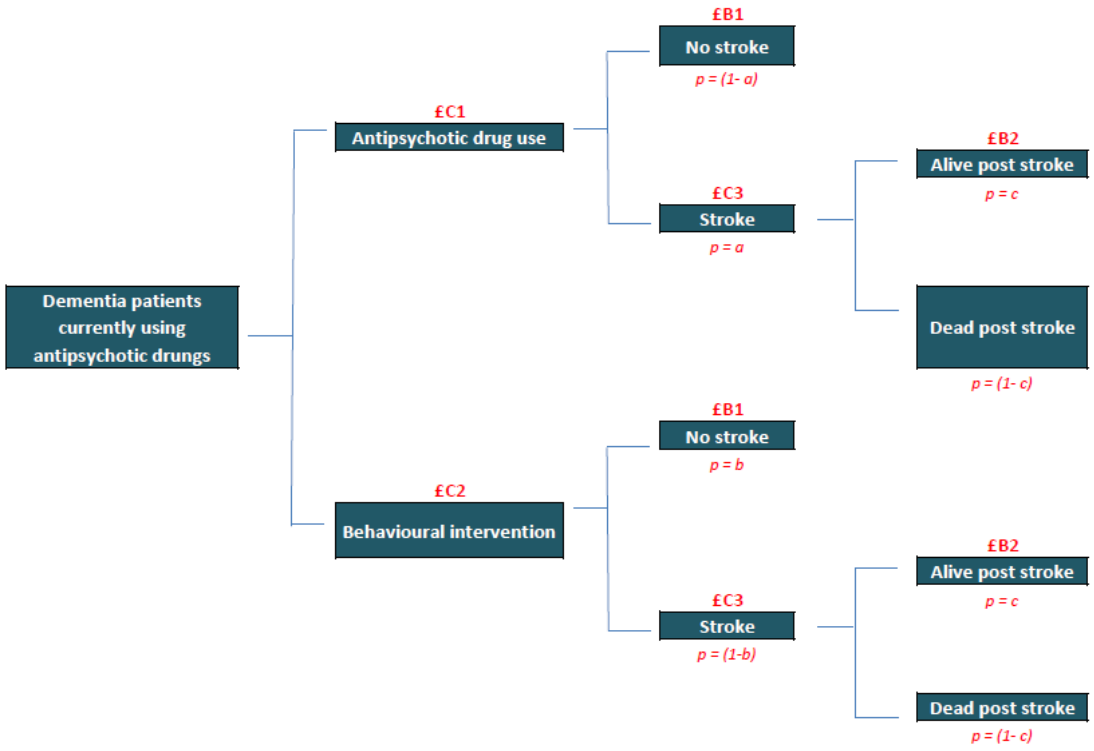


Figure A.2. A decision model for providing behavioural interventions as an alternative to antipsychotics - falls

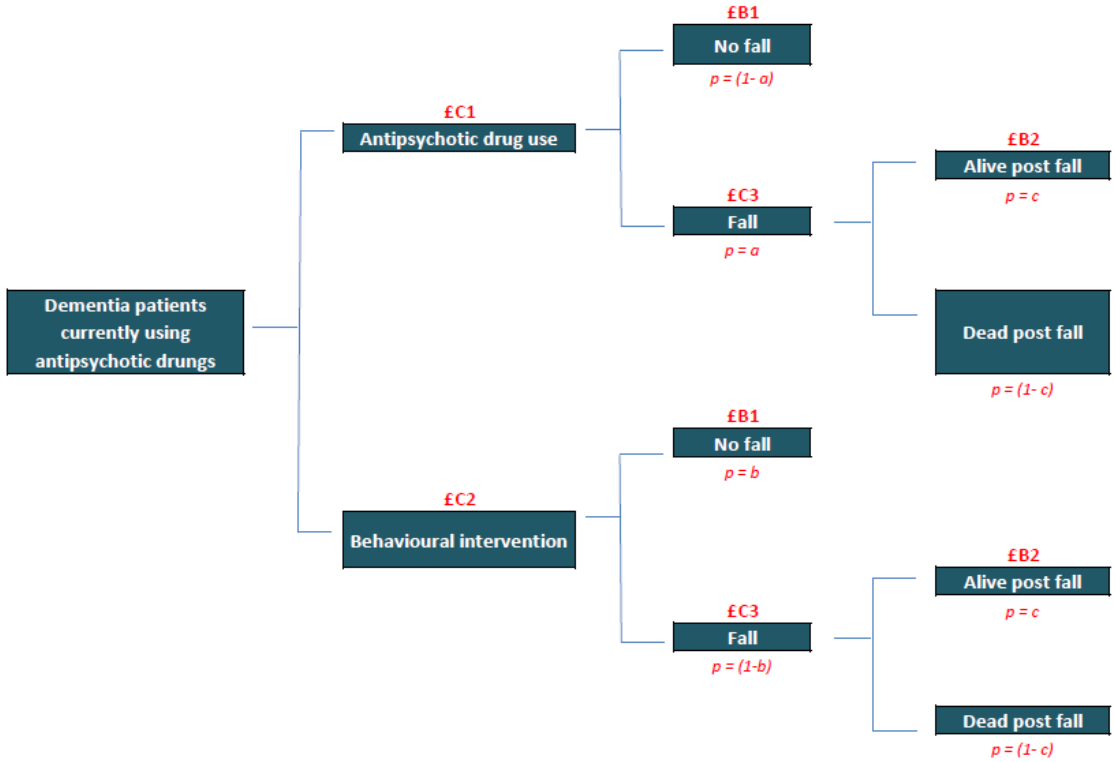


Table A.1. Parameters used to populate a decision model for the impact of behavioural interventions on stroke compared to antipsychotic drug use (monetary values in £2009/10 prices)

Ref	Description	Value	Calculation and sources
£C1	Cost of antipsychotic drug use per person living with dementia per year	£501	Total annual expenditure in UK on antipsychotic drug use = £80 million (Banerjee 2009). Percentage of total budget attributable to England = 84 per cent (NHS Information Centre (2008), Ibid, Office for National Statistics (2001) Scotland (2009). Total England population = 51,220,237 (NHS Information Centre (2008) Dementia population in England= 668,566 (Dementia UK 2010) Probability individuals living with dementia require antipsychotic drug use = 20 per cent (MedRec Stop Press 947) Cost per person living with dementia = [£80,000,000*0.84]/[668,556 * 0.20] = £501.
£C2	Cost of behavioural intervention per person living with dementia per year	£707	Behavioural intervention = 1 session per day for 45 minutes = 5.25 hours per week. (Spector 2003) Number of individuals per group: minimum = 8 people, maximum (not provided). Maximum assumed to be 16. Average number of individuals per group = 12. (Spector 2003) Hours per year per person living with dementia= [5.25 * 52]/12=22.8 hours. Spector 2003 does not define who delivers the intervention. Assumed a NHS community mental health team (CMHT) worker for older people (OP) would deliver the intervention. Cost per hour = £31 (PSSRU, 2010). Cost of behavioural intervention = £31*22.8 = £707.
£C3	Cost per stroke	£52,471	Total cost of stroke to the UK per year = £7,646,031,000 (Saka 2009). Total number of strokes in the UK per year = 150,000 (Stroke Association, 2010). Cost per stroke = (£7,646,031,000/150,000) = £50,973. Cost per stroke adjusted to 2010 prices using GDP deflator = 1.029. Cost per stroke = £50,973 * 1.029 = £52,471

Ref	Description	Value	Calculation and sources
a	Probability of stroke when using antipsychotic drugs	0.019	Derived directly from Schneider et al (2006)
b	Probability of stroke when using a behavioural intervention	0.009	Derived directly from Schneider et al (2006). Behavioural intervention probability assumed to be same as placebo arm in Schneider et al (2006).
c	Probability of being alive post stroke	0.40	Derived directly from Dilip V Jeste et al. 2007
£B1	Monetary value of QALY associated with no stroke	£16,000	QALY value associated with individuals living with dementia without stroke = 0.80 (McMahon 2003) Monetary value of QALY = £20,000 (The lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Clinical Excellence (NICE))
£B2	Monetary value of QALY associated with stroke	£11,930	QALY value associated with individuals living with dementia with stroke = 0.60 (Tammy 2001). Monetary value of QALY = £20,000 (The lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Clinical Excellence (NICE))

Table A.2. Parameters used to populate a decision model for the impact of behavioural interventions on falls compared to antipsychotic drug use (monetary values in £2009/10 prices)

Ref	Description	Value	Calculation and sources
£C1	Cost of antipsychotic drug use per person living with dementia per year	£501	Total annual expenditure in UK on antipsychotic drug use = £80 million (Banerjee 2009). Percentage of total budget attributable to England = 84 per cent (NHS Information Centre (2008), Ibid, Office for National Statistics (2001) Scotland (2009). Total England population = 51,220,237 (NHS Information Centre (2008) Dementia population in England= 668,566 (Dementia UK 2010) Probability individuals living with dementia require antipsychotic drug use = 20 per cent

Ref	Description	Value	Calculation and sources
			(MedRec Stop Press 947) Cost per person living with dementia = [£80,000,000*0.84]/[668,556 * 0.20] = £501.
£C2	Cost of behavioural intervention per person living with dementia per year	£707	Behavioural intervention = 1 session per day for 45 minutes = 5.25 hours per week. (Spector 2003) Number of individuals per group: minimum = 8 people, maximum (not provided). Maximum assumed to be 16. Average number of individuals per group = 12. (Spector 2003) Hours per year per person living with dementia= [5.25 * 52]/12=22.8 hours. Spector 2003 does not define who delivers the intervention. Assumed a NHS community mental health team (CMHT) worker for older people (OP) would deliver the intervention. Cost per hour = £31 (PSSRU, 2010). Cost of behavioural intervention = £31*22.8 = £707.
£C3	Cost per fall	£2,264	Average cost of fall in elderly = £1,897 (Scuffham and Chaplin 2003). Cost adjusted to 2010 prices using GDP deflator = 1.19 Cost per fall = £1,897 * 1.19 = £2,264
a	Probability of fall when using antipsychotic drugs	0.024	Three sources predicted the increased risk of falling in elderly due to antipsychotic drug use: 1. Ray (1997) = estimated 44 per cent increase, Landi (2005) = 47 per cent increase, Hien (2005) = 59.7 per cent increase. Average value = 50.2 percent. Estimated 7.5 per cent of all elderly falls require treatment (Rubenstien 2002). Probability of falling (which requires treatment) when using antipsychotic drugs = probability of falling without antipsychotic drugs * (1 +(.502 *.075)) = .023 (found below) * (1 +(.502 *.075)) = 0.23 * 1.037 = .024.
b	Probability of fall when using a behavioural intervention	0.023	Average fall used across three sources: 1. HES 2007 = 224,000 admissions due to falls out of 8,000,000 elderly patients = 2.8 per cent, 2. Scuffham/Chaplin (2003) = 204,424 admissions due to falls out of 12,100,000 elderly patients = 1.7 per cent, 3. Reiefkohl (2003) = 35 per cent of elderly fall, 7.5 per cent require treatment = 2.6 per cent.

Ref	Description	Value	Calculation and sources
			Average value = (.028 + .017 + .026)/3 = 0.023.
c	Probability of being alive post fall	0.014	Derived directly from NICE (2004)
£B1	Monetary value of QALY associated with no fall	£16,000	QALY value associated with individuals living with dementia without stroke = 0.80 (McMahon 2003) Monetary value of QALY = £20,000 (The lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Clinical Excellence (NICE))
£B2	Monetary value of QALY associated with fall	£14,200	QALY value associated with individuals living with dementia with stroke = 0.71 (NICE 2004). Monetary value of QALY = £20,000 (The lower end of the range of QALY values implicit in the decision making process followed by the National Institute of Clinical Excellence (NICE))

8.0 Appendix 2. Literature search results

Table A2.1 summaries all the studies identified in the literature search regarding the effect of antipsychotic drugs on the risk of stroke in individuals living with dementia.

Table 2. Risk of stroke when using antipsychotic drugs in individuals living with dementia

Reference	Intervention	Counterfactual	Number of trials included in study	Population in study	Probability of stroke– no antipsychotics (intervention)	Probability of stroke – with antipsychotics (counterfactual)
Schneider et al (2006)	Aripiprazole, olanzapine, quetiapine, risperidone	Placebo	15	Elderly individuals with dementia	0.9%	1.9%
Dilip V Jeste et al. 2007	Risperidone	Placebo	3	Elderly individuals with dementia	0.7%	1.6%
Herman and Lanctot 2005	Risperidone/ Olanzapine	Placebo	11	Elderly individuals with dementia	0.8%	2.2%
Schneider et al (2005)	Quetiapine	Placebo	2	Elderly individuals with dementia	0.9%	1.9%