

QQUIP

Quest for
Quality and
Improved
Performance

Bridging the quality gap

Stroke

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Overview

Stroke is a disease that has a marked impact on the length and quality of many people's lives. In England each year there are more than 110,000 strokes – one quarter of these affect people under the age of 65. About 300,000 people are living in England with moderate to severe stroke disabilities, making stroke the leading cause of severe adult disability.

The financial costs of stroke – directly to the healthcare system and indirectly to society as a whole – are significant. Total costs to the National Health Service (NHS) and the economy have been estimated to be £7 billion a year, comprising:

- £2.8 billion in direct costs to the NHS
- £2.4 billion in informal care costs (for example, the costs of home nursing borne by patients' families)
- £1.8 billion in income lost to productivity and disability (Saka *et al*, 2005).

International comparisons show that quality of stroke care in England could be improved significantly: England lags behind comparator countries for rates of mortality, and there is unevenness in the availability of skilled facilities and in the provision of treatments that have been shown to improve outcomes.

This chartbook focuses on quality of stroke care. Quality is broadly defined, encompassing the key domains of effectiveness, access, safety, structural capacity, patient responsiveness and equity.

The chartbook comprises three main sections. Section 1 presents epidemiological data and summarises recent policy documents on stroke. The contents of this section may represent familiar territory to many readers, but it is included to provide the context against which quality can be judged. Section 2 presents data on quality of care in stroke and illustrates the gap between actual and achievable performance. It draws on data from disparate sources and highlights deficiencies in stroke services and variation in care across the country. It also provides international benchmarks to help define what level of performance is attainable in stroke services. Section 3 summarises available evidence about how to bridge the quality gap in stroke care. Drawing on systematic reviews of the literature, it illustrates the current state of knowledge about 'what works' to improve organisational performance and presents emergent research data on the costs involved in bridging the quality gap.

Accompanying the chartbook is a commentary written by Maxine Power, Associate Director for Quality Improvement at Salford Royal Foundation NHS Trust. The commentary draws on international experience in improving stroke care and highlights the critical need for concerted effort and action in England. The commentary is available on The Health Foundation website www.health.org.uk

Section 1: Stroke – epidemiology, economic burden and policy context

This section sets the scene for this report and provides:

- basic epidemiological and cost data
- an outline of the policy context
- a summary of recent seminal publications that have catalysed efforts to bridge the quality gap.

Chapter 1: Introduction and background

Stroke is a relatively common illness and one that has significant consequences for both public expenditure and human suffering:

- a quarter of the population over the age of 45 years will have a stroke (RCP, 2004)
- stroke is the third most common cause of death in England and accounts for 11 per cent of deaths each year
- approximately one-third of stroke patients die within a year of a first stroke
- after one year around 40 per cent of patients are dependent (Appelros *et al*, 2003)
- there are more than 900,000 people who have had a stroke living in England (National Audit Office, 2005).

Stroke accounts for significant healthcare expenditures. Cost studies conducted in 6 countries over a 20-year period found that, on average, 3 per cent of healthcare budgets is spent on stroke (Evers *et al*, 2004).

In the United Kingdom (UK), it has been estimated that every stroke patient costs the NHS £15,000 over five years. When informal care costs are included, this increases to £29,000 (Youman *et al*, 2003).

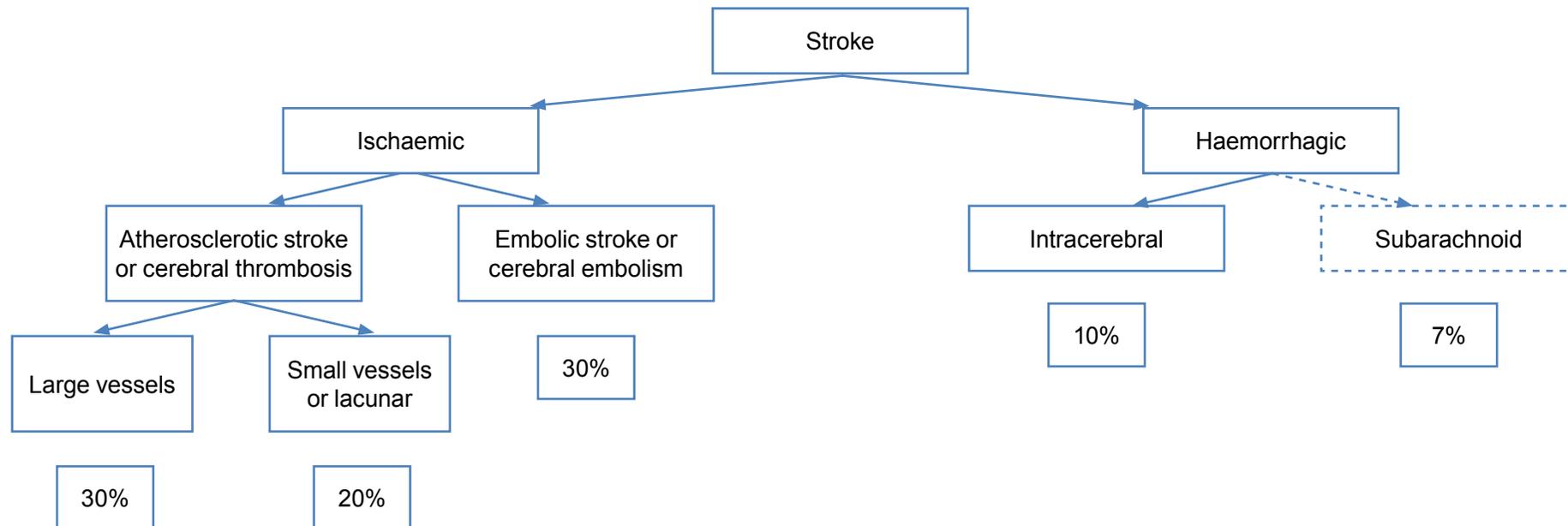
A National Audit Office (NAO) report (2005) estimated that stroke costs £2.8 billion per year in NHS direct care costs, £1.8 billion in lost productivity and disability and £2.4 billion in informal care costs (such as home nursing and family-provided care).

In the last several years there has been a growing awareness of, and concern about, deficiencies in stroke care in England. In response, the Government released its *National Stroke Strategy* in December 2007 (Department of Health).

What is a stroke?

A stroke, also known as a cerebrovascular accident (CVA), is ‘the brain equivalent of a heart attack’ (NAO, 2005). A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain either gets blocked by a clot (an ischaemic stroke) or bursts and bleeds (a haemorrhagic stroke). As a result, the area of the brain supplied by that blood vessel is damaged or dies. The severity and consequences of stroke vary dramatically, from a limited episode known as a transient ischaemic attack (TIA) or ‘mini stroke’ with no persisting harm to a severe incident that causes death or permanent disability. The diagram below depicts the most common stroke classification with incidence estimates.

Despite having the same symptoms, ischaemic and haemorrhagic strokes need very different treatment. For instance, anticoagulation drugs that reduce the clotting ability of the blood might be a good therapy for ischaemic strokes but will increase the risk of haemorrhagic ones. Similarly, thrombolysis which is effective in busting blood clots for ischaemic patients would worsen the condition of a haemorrhagic one.

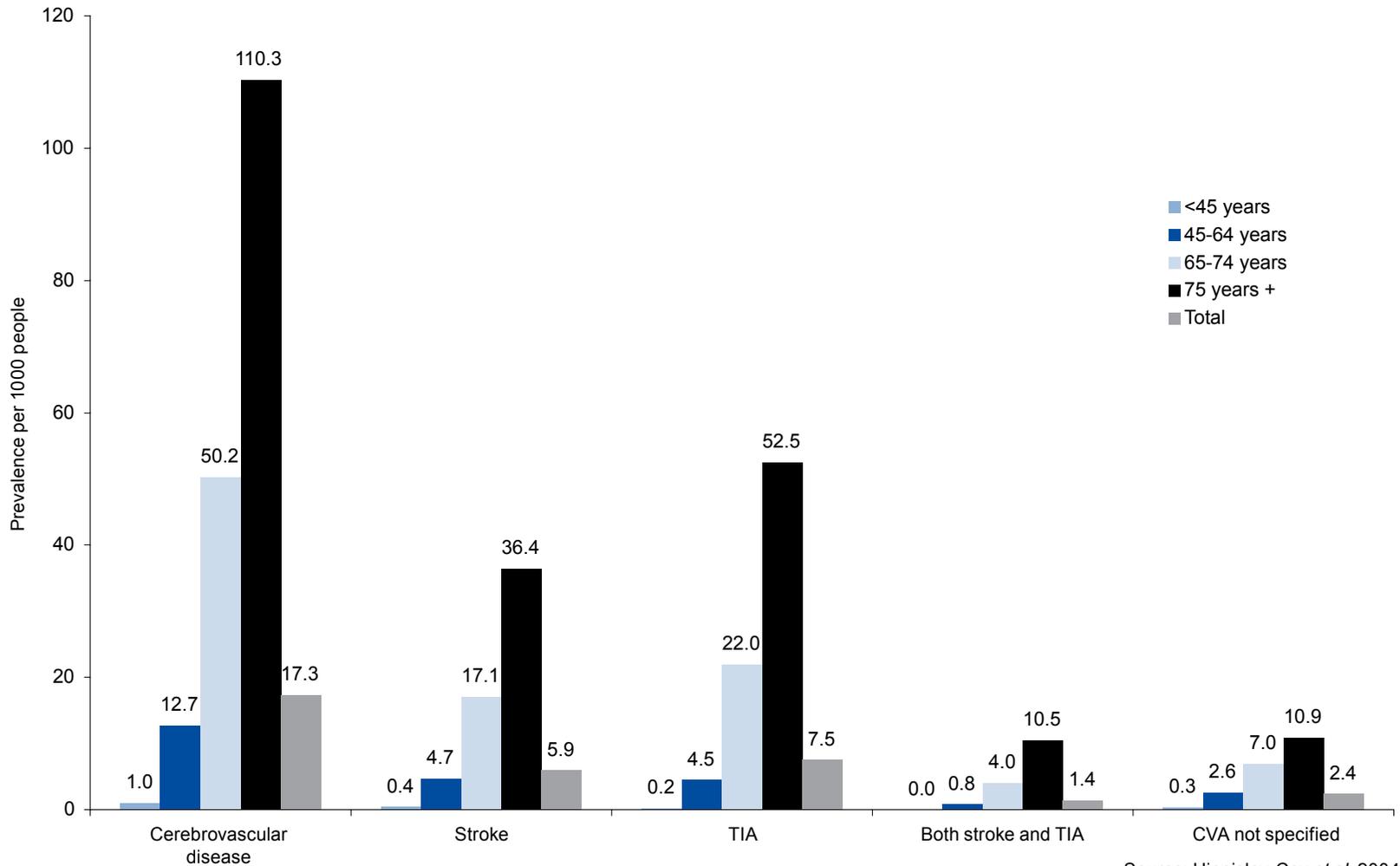


Source: www.strokecenter.org/education/ais_stroke_types/stroke_types.htm; Wolfe *et al*, 2002

Prevalence of stroke

Drawing on a large sample of 1.48 million patients registered with 200 GP practices in England, QRESEARCH estimated the prevalence of stroke and TIA by geographical area and by age. The prevalence figures varied significantly within England, from 11.6 (east) to 18.9 (north east) per 1000 persons; the national average was 17.3 per 1000 in the two-year period of 2004 to 2005 (data not shown). The graph below illustrates prevalence by age, stratified into types of cerebrovascular disease (Hippisley-Cox *et al*, 2004).

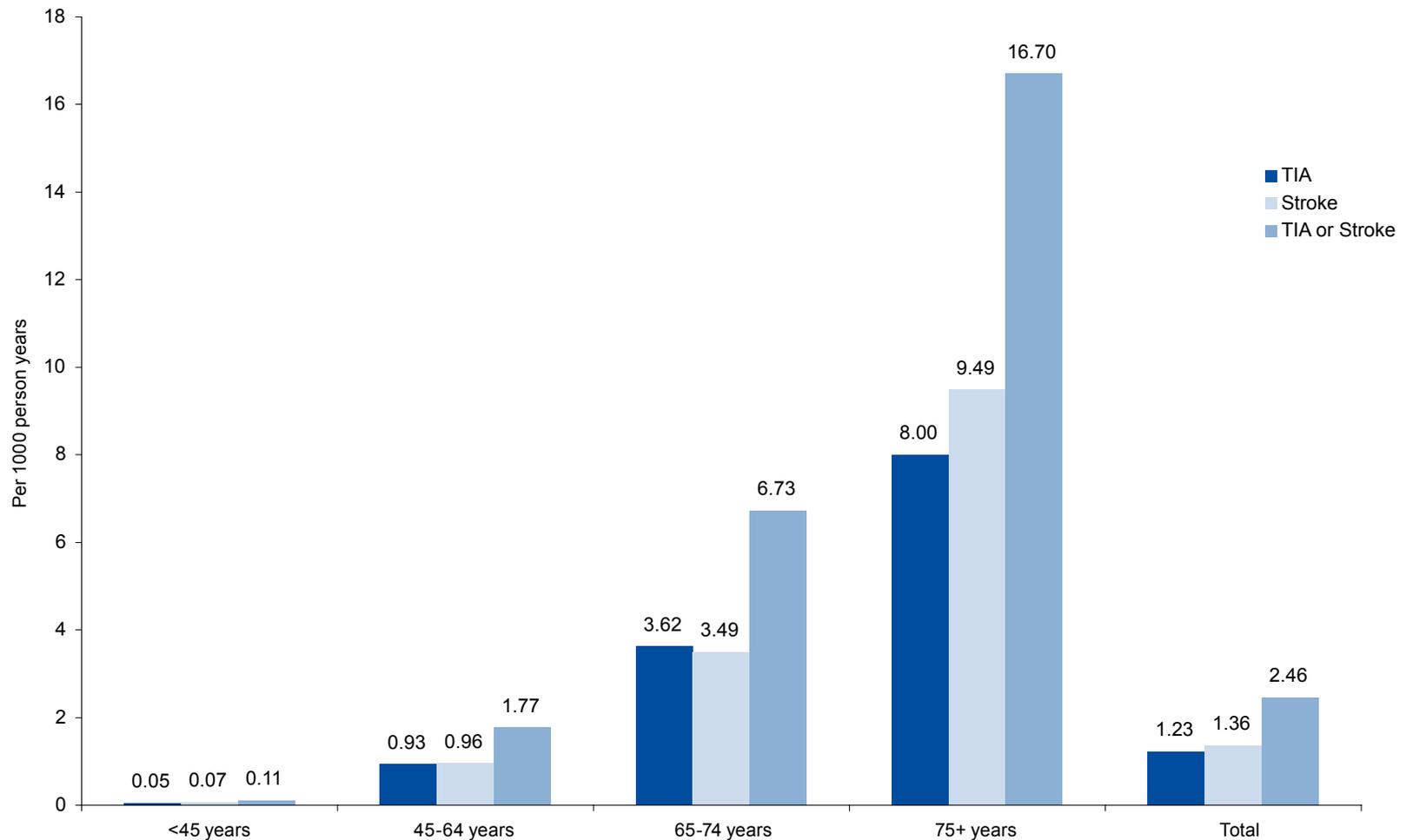
Prevalence of stroke by age, England 2004



Incidence of stroke

Analysis conducted by QRESEARCH on 1.48 million patients registered with 200 GP practices in England estimated the incidence of stroke to be 1.36 per 1000 person years and of TIAs to be 1.23 per 1000 person years. The chart shows that incidence is highest in older patients. There are similar incidence rates for males and females (data not shown).

Incidence of stroke and TIA, England, 2002-04



Source: Hippisley-Cox *et al*, 2004

Stroke risk factors

Risk factors for stroke can be hereditary, a function of natural processes (such as ageing) or a result of lifestyle choices. Lifestyle or environmental factors are the most amenable to change and this table summarises a selection of risk factors that can be changed, treated or controlled.

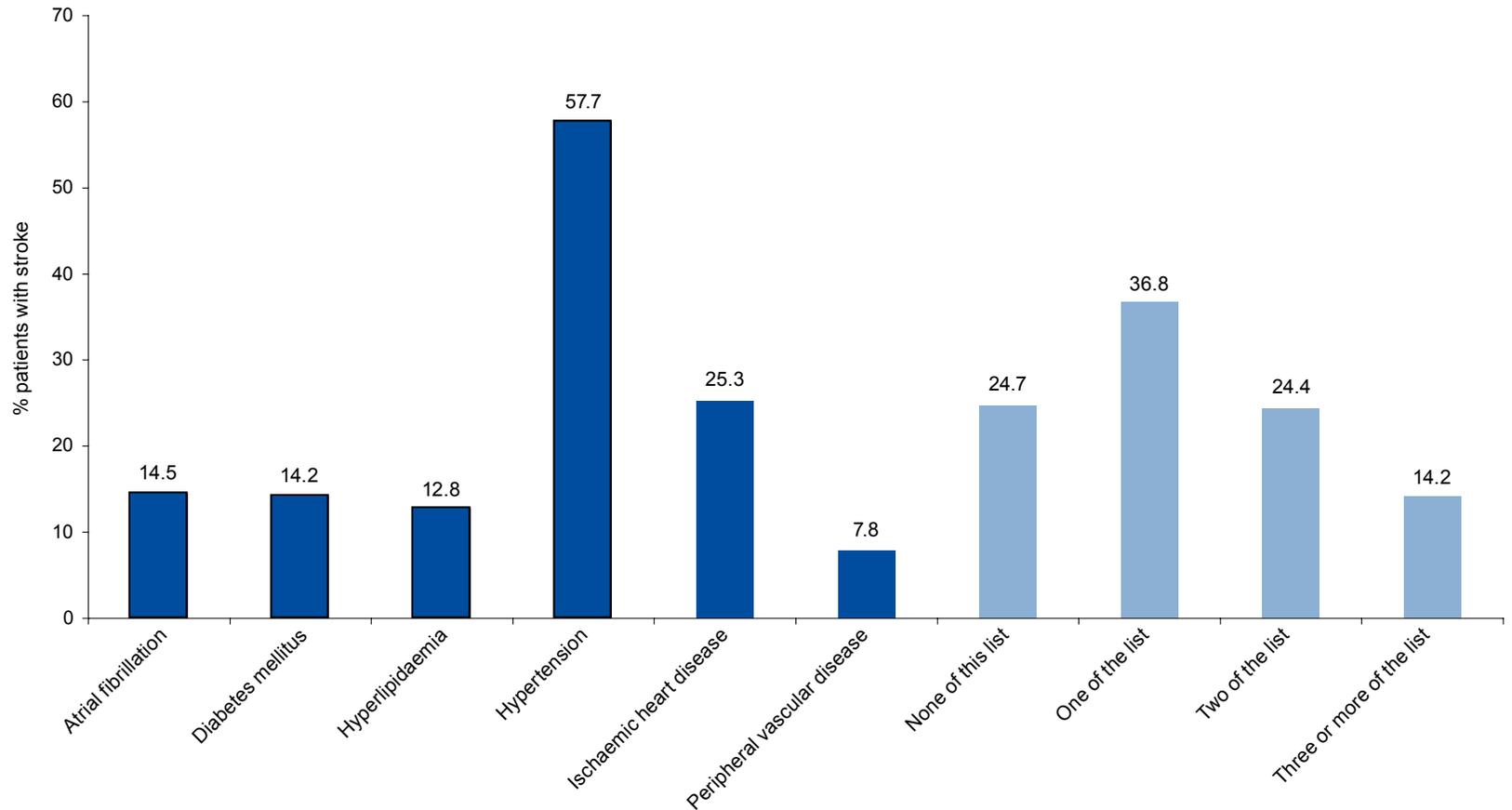
High blood pressure	Hypertension is one of the most important risk factors in stroke because it weakens the artery walls. People with high blood pressure have a four-fold increased risk of incurring a stroke.
Cigarette smoking	A person who smokes 20 cigarettes a day has 6 times the risk of stroke compared with a non-smoker. Cigarette smoking increases the risk of developing atherosclerosis – a condition characterised by fatty deposits or plaques building up inside the arteries – and may lead to clot formation and disruption of the blood supply to the brain and other organs. The use of oral contraceptives combined with cigarette smoking increases stroke risk.
Transient ischaemic attack (TIA)	A TIA is a temporary interruption of blood supply which produces stroke-like symptoms that clear up within 24 hours. A person who has a TIA is likely to suffer a more severe stroke in the near future.
Diabetes mellitus	People with diabetes are at double the risk of experiencing a stroke. Many people with diabetes also have high blood pressure, high blood cholesterol and are overweight. Effective control can delay complications that increase the risk of stroke.
Heart disease	People with coronary heart disease or heart failure have an increased risk of stroke. Dilated cardiomyopathy, heart valve disease and some types of congenital heart defects also raise the risk of stroke. Atrial fibrillation, where the heart's upper chambers quiver instead of beating effectively, can let the blood pool and clot. A stroke results if a clot breaks off, enters the bloodstream and lodges in an artery leading to the brain.
Poor diet/high alcohol intake	Diets high in saturated fat, trans-fat and cholesterol can raise blood cholesterol levels; diets high in sodium (salt) can contribute to increased blood pressure. Obesity, high cholesterol and high blood pressure all contribute to the development of atherosclerosis. Heavy drinkers have a three-fold increased risk of stroke.
Physical inactivity and obesity	Being inactive, obese or both can increase the risk of high blood pressure, high blood cholesterol, diabetes, heart disease and stroke.

Source: www.betterhealth.vic.gov.au/BHCV2/bhcarticles.nsf/pages/Stroke_the_risk_factors?OpenDocument

Comorbidities with stroke

The previous chart listed the major risk factors for stroke. Many of these risk factors are diseases and are often referred to as comorbidities. Crucially, these diseases are linked via common lifestyle factors. This chart illustrates prevalence data from England detailing the extent to which various circulatory diseases and diabetes are present in stroke patients.

Comorbidities with stroke, England 2004



Source: Hippisley-Cox *et al*, 2005

Recognising a stroke: time is brain

Failure to recognise stroke symptoms and to respond urgently can mean that crucial medical treatment is delayed with serious consequences for outcomes. Typically, 1.9 million neurons are lost for each minute a stroke goes untreated. Every stage of the patient journey to treatment is therefore time critical (Department of Health, 2007).

A MORI poll commissioned by the Stroke Association in 2005 found that only 50 per cent of people could correctly identify a stroke. If confronted with someone whom they suspected may have had a stroke, 60 per cent would contact their GP or NHS Direct, and only a third would call an ambulance or go to hospital. Further, healthcare professionals do not all treat stroke as a medical emergency: according to the NAO, nearly one in five GPs do not refer around a fifth of cases of a TIA or stroke. Fewer than 60 per cent of GPs said they would immediately refer someone with a suspected stroke.

The Face Arm Speech Test (FAST) was developed in the UK in 1998 and contains three key elements: facial weakness, arm weakness and speech disturbances. FAST provides a method to quickly assess patients with suspected stroke and has been shown to have high levels of diagnostic accuracy when used by paramedics (Harbison, *et al*, 2003; Nor *et al*, 2004).

**Suspect a stroke?
Act FAST. Call 999.**

F **Facial weakness**
Can the person smile? Has their mouth or eye drooped?

A **Arm weakness**
Can the person raise both arms?

S **Speech problems**
Can the person speak clearly and understand what you say?

T **Test all three symptoms**

Stroke is a medical emergency.
By calling 999 early treatment can be given which can prevent further brain damage.

Stroke helpline 0845 3033 100 www.stroke.org.uk

The STROKE
ASSOCIATION

Costs of stroke in England: indirect and direct

Around the world, stroke is a significant burden on both human suffering and healthcare costs. According to the OECD, stroke accounted for 10 per cent of all deaths worldwide in 1999 and amounted to between 2 and 4 per cent of total health system expenditure (Moon *et al*, 2003). These were matched by similarly significant costs incurred outside the healthcare system because of subsequent loss of earnings and the cost burden on state benefits systems. In England, the direct and indirect costs resulting from stroke have been estimated to be around £7 billion per year (Saka *et al*, 2005). Total annual direct care accounts for approximately 40 per cent, informal care for 35 per cent and indirect costs for approximately 25 per cent.

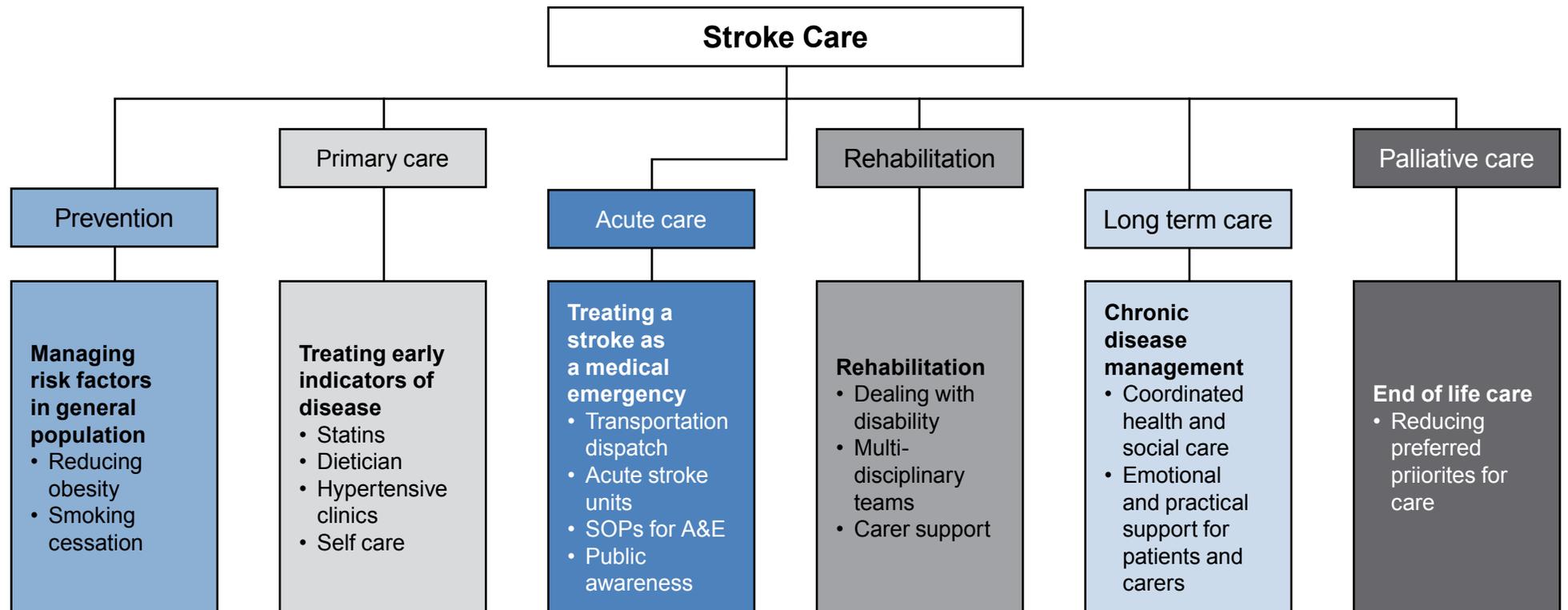
Costs of stroke in England	(£)
Diagnostic costs	9,600,000
Inpatient care costs	530,000,000
Outpatient care costs	46,200,000
Outpatient drug costs	507,200,000
Community care costs	1,741,100,000
Total annual direct care cost	2,834,100,000
Total informal care costs	2,406,400,000
Income lost due to mortality	483,700,000
Income lost due to morbidity	604,100,000
Benefit payments	686,600,000
Total annual indirect costs	1,774,400,000
Total	7,014,900,000

Source: Saka *et al*, 2005

Chapter 2: Context of stroke care – policy documents and evidence-based guidelines

Around the world stroke has become a priority clinical area in the past decade. Models of care have evolved rapidly, moving from what some describe as an overriding sense of nihilism (Donnan *et al*, 2007) with patients often left to languish in general medical wards towards active management in dedicated stroke units and use of evidence-based interventions that have been shown to improve outcomes. Policy-makers

increasingly recognise that stroke is a complex disease and care is delivered across a range of clinical settings ranging from preventive care to palliative care services (see chart below). Levels of increased attention and activity are illustrated by the policy activity in this area. The following page outlines briefly key policy publications and independent reports on the state of stroke care.



Policy context in England

In recent years concern has grown about NHS performance in stroke care, and this has resulted in various policy publications and reports. This table identifies some of the key publications and initiatives (see Appendix 1 for further details).

Department of Health	<ul style="list-style-type: none"> • <i>National Service Framework for Older People</i> (2001) pledged to reduce the incidence of stroke and to ensure that stroke patients have prompt access to integrated stroke care services • <i>National Stroke Strategy</i> (2007) articulated a 10-point plan for action (see page 85)
National Audit Office	<ul style="list-style-type: none"> • <i>Reducing Brain Damage: faster access to better stroke care</i> (2005) brought together quality and cost-effectiveness data • <i>Joining Forces to Deliver Improved Stroke Care</i> (2007) reported the proceedings of a conference which sought to bring together key players and develop a shared understanding of what is needed to improve quality
Royal College of Physicians	<ul style="list-style-type: none"> • <i>Sentinel Stroke Audit</i> is released biennially and systematically collects data on performance, facilities and standards of care – it has played a pivotal role in engaging clinicians, highlighting quality deficiencies and identifying priorities for improvement • <i>National Clinical Guidelines for Stroke</i> (2004) covers the management of stroke, TIA and subarachnoid haemorrhage and summarises context, recommendations, key references and the quality of the evidence
National Institute for Health and Clinical Excellence (NICE)	<ul style="list-style-type: none"> • The diagnosis and acute management of stroke and transient ischaemic attacks (in development)

Note: In Scotland, the Scottish Intercollegiate Guideline Network (SIGN) also produces relevant guidelines

Section 2: Quality of care

Chapter 3: What is quality of care?

Quality in healthcare is a multifaceted concept, not amenable to a single performance measure or simple metric. In the past decade there has been a concerted effort to improve measurement and reporting. A growing consensus about the key domains of quality in healthcare, and relevant measures and indicators to populate those domains, has emerged (Institute of Medicine, 2001; OECD, 2002; AHRQ, 2003). The table below outlines the six key domains used by the authors to evaluate and monitor quality of care generally (Leatherman and Sutherland, 2003; 2005). These domains are used to present the data on quality of stroke care in the NHS. The data is configured to illustrate various aspects of performance including:

- international comparisons to contextualise performance
- longitudinal time series to track changes over time
- one-off 'snapshots' to gauge performance at a single point in time (often against predefined standards)
- variation charts to illustrate variability of performance within the healthcare system.

The criteria used to determine which indicators to include in the chartbook were:

- relevance: indicators are clinically meaningful or important to patient experience
- methodological rigour: the data has credence and validity and the indicators are based on a sound evidence base
- balance: the data contributes to a multifaceted picture of quality in stroke care
- timeliness: the data provides an up-to-date assessment of quality.

Effectiveness

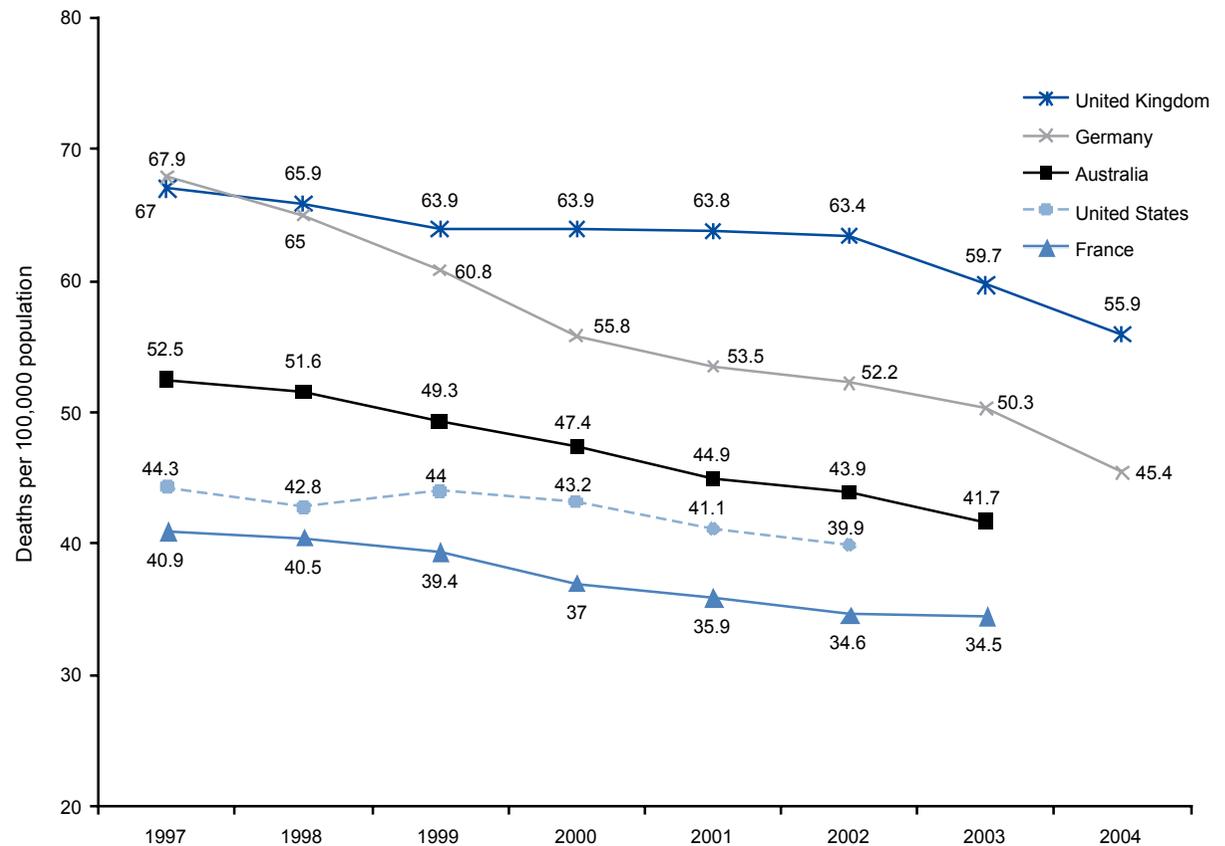
Effectiveness refers to the extent to which an intervention produces its intended result. Effectiveness in the context of the quality of healthcare also encompasses the concept of 'appropriateness', the extent to which interventions or services are provided to all those who could benefit and withheld from those who would not. Effectiveness indicators can focus on outcomes, such as mortality or survival rates, or on processes that have been proven to affect those outcomes and which can be used as more immediate measures of quality.

Quality domain	Principle	Examples of measures
Effectiveness	Healthcare services should be based, as far as possible, on relevant rigorous science and research evidence.	<ul style="list-style-type: none"> • Mortality rates • Compliance rates with evidence-based guidelines
Access and timeliness	Healthcare services should be provided at the time they are needed within the appropriate setting.	<ul style="list-style-type: none"> • Provision of emergency care • Availability of specialist care or rehabilitation
Capacity	Healthcare systems should be sufficiently well resourced to enable delivery of appropriate services.	<ul style="list-style-type: none"> • Staffing levels • Number of scanners
Safety	Patients should not be harmed by the care that they receive or exposed to unnecessary risk.	<ul style="list-style-type: none"> • Nosocomial infections • Medication errors • Falls
Patient-centredness	Healthcare should be: <ol style="list-style-type: none"> 1. based on a partnership between practitioners and patients (and where appropriate, their families) 2. delivered with compassion, empathy and responsiveness to the needs, values and preferences of the individual patient. 	<ul style="list-style-type: none"> • Survey data on: <ul style="list-style-type: none"> • patient evaluations of care • shared decision-making • patient experiences and interactions with staff
Equity	Healthcare should be provided: <ol style="list-style-type: none"> 1. on the basis of clinical need, regardless of personal characteristics such as age, gender, race, ethnicity, language, socioeconomic status or geographical location 2. in such a way as to reduce differences in health status and outcomes across various subgroups. 	<ul style="list-style-type: none"> • Comparisons of care provided across different sub-populations (for example, older people versus entire population) • Mortality rates by socioeconomic status

Cerebrovascular disease mortality: international comparison

Cerebrovascular disease (CVD) involves the blood vessels within or supplying the brain. CVD makes it more likely that a stroke will occur, either through a sudden blockage or a rupture of a blood vessel within the brain. The blockage may be due to a blood clot forming in the cerebral arteries (a thrombosis) or by a fragment of material (blood clot, piece of tissue, cholesterol or various other substances) travelling in the blood stream (an embolism). The chart shows that, internationally, mortality rates from CVD have been falling steadily. The UK saw a 16 per cent fall in mortality rates between 1997 and 2004; however, over the same time frame Germany saw a 33 per cent reduction. The UK still has a high mortality rate relative to comparator countries.

Mortality from cerebrovascular disease, international comparison, 1997-2004

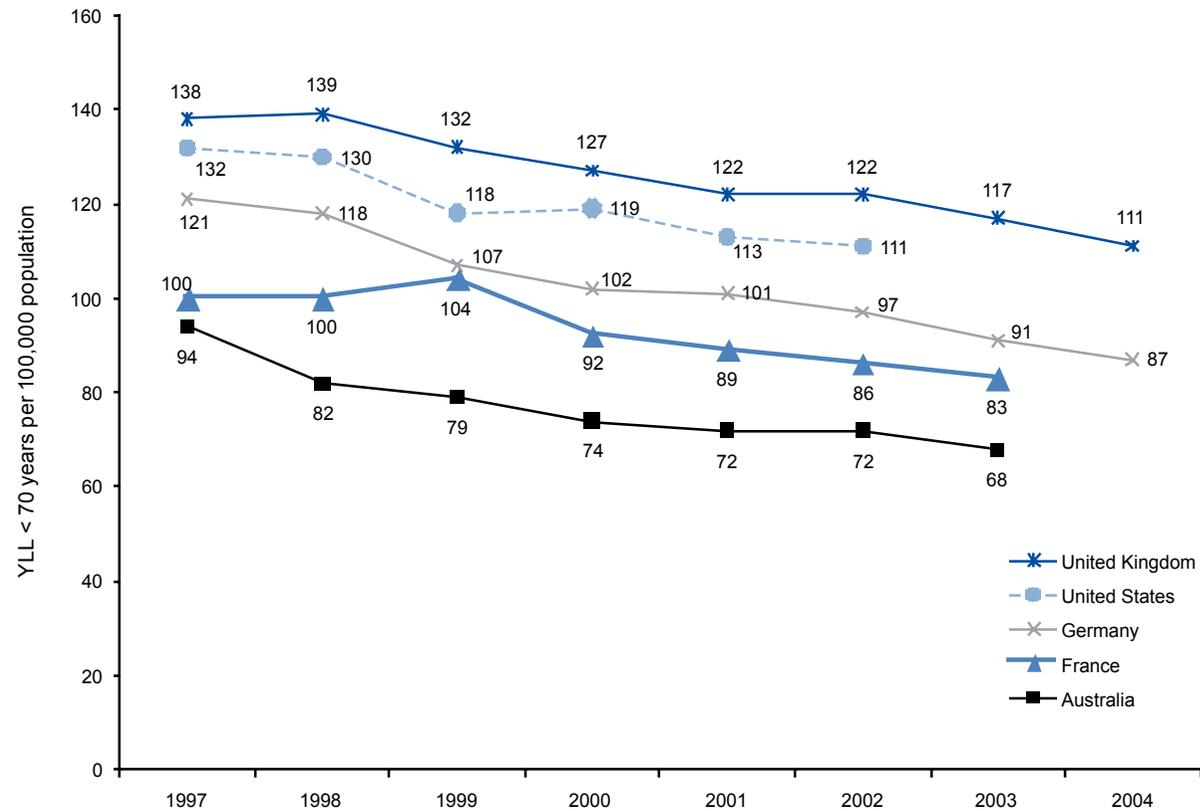


Source: OECD, 2007

Potential years of life lost to cerebrovascular disease: international comparison

Potential Years of Life Lost (YLL) is a summary measure of premature mortality. YLL is the sum of deaths from CVD occurring at each age and multiplying this by the number of remaining years to live up to a selected age limit (which, in the case of this OECD data, is 70 years). The chart shows that the most marked improvement was achieved by Germany and Australia with a 28 per cent reduction in YLL. Of the countries shown the UK (despite a reduction of 20 per cent) has the most potential YLL lost to CVD.

Potential years of life lost due to cerebrovascular disease, international comparison, 1997-2004

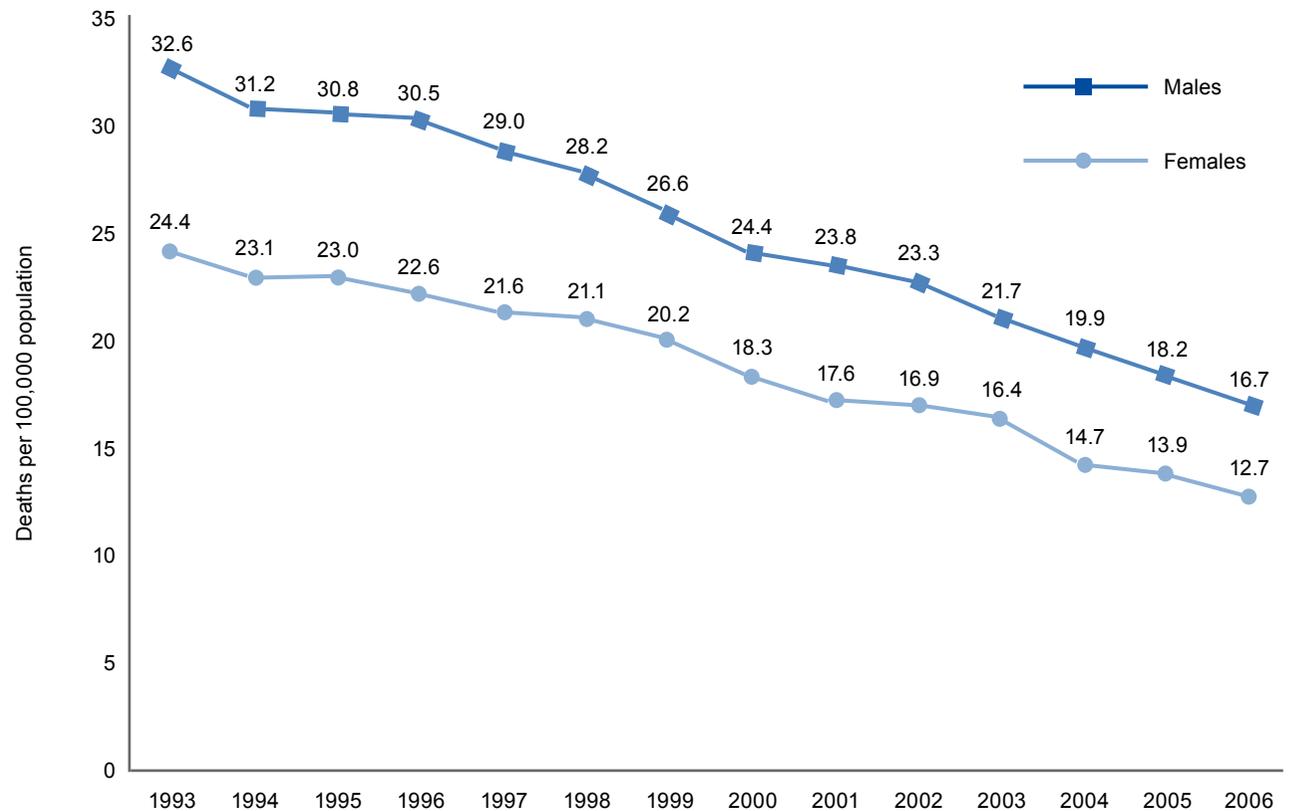


Source: OECD

Mortality from stroke

Stroke is the third most common cause of death in England (Committee of Public Accounts, 2006) and is responsible for 11 per cent of all deaths (RCP, 2004). Thirty per cent of stroke victims will die, most within the first ten days (Carroll *et al*, 2001). This chart shows that, for people aged less than 75 years, mortality rates from stroke between 1993 and 2006 declined in males by 49 per cent and in females by 48 per cent. Although this represents a significant improvement, stroke mortality rates for England lag behind many comparator countries (see page 23).

Mortality rates from stroke (people aged under 75 years), England, 1993-2005

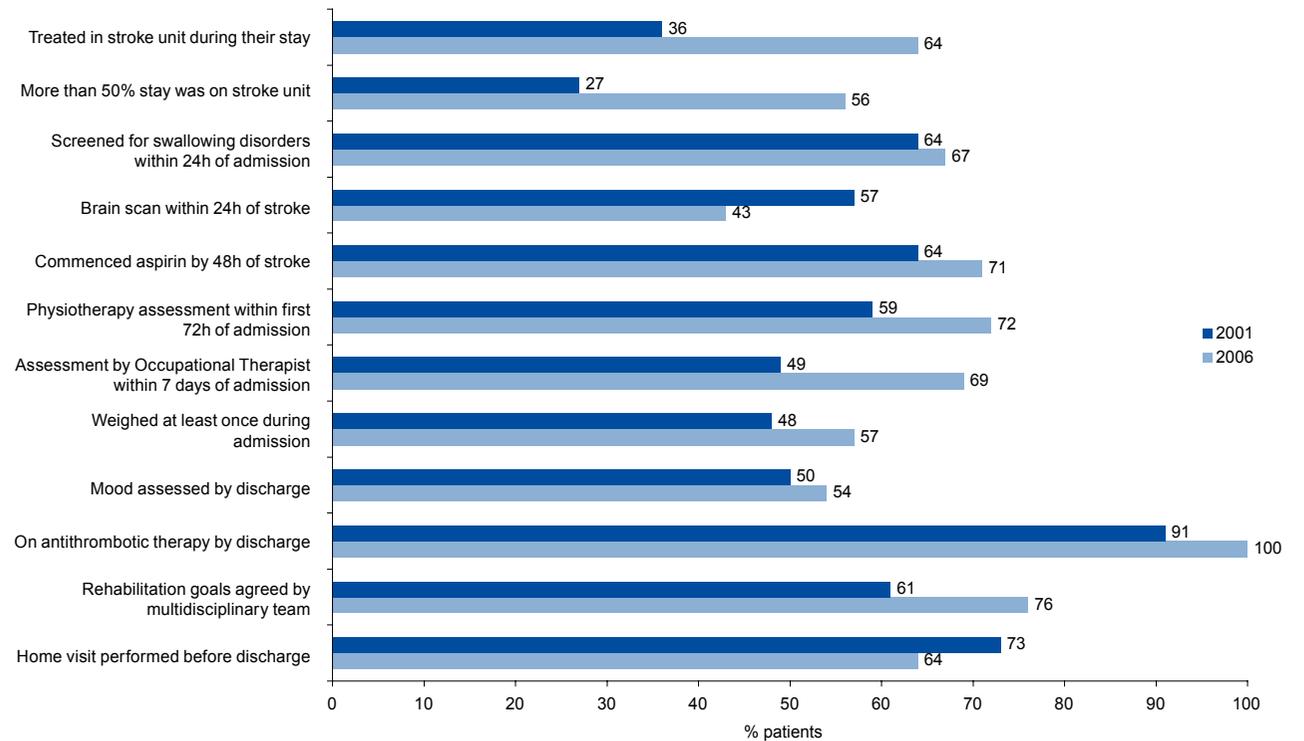


Source: NCHOD

Key indicators for stroke care

The Sentinel Stroke Audit collects process data retrospectively from patient records (RCP, 2002; 2005; 2006). It gauges performance against 12 key standards of care that have been derived from systematically retrieved and critically appraised research evidence. They have been agreed by experts in all disciplines involved in the management of stroke. The chart illustrates performance in England against these standards and highlights a general improvement in all areas. Subsequent charts illustrate the extent of variation within England.

Key indicator scores, Sentinel Stroke Audit, England, 2001 and 2006



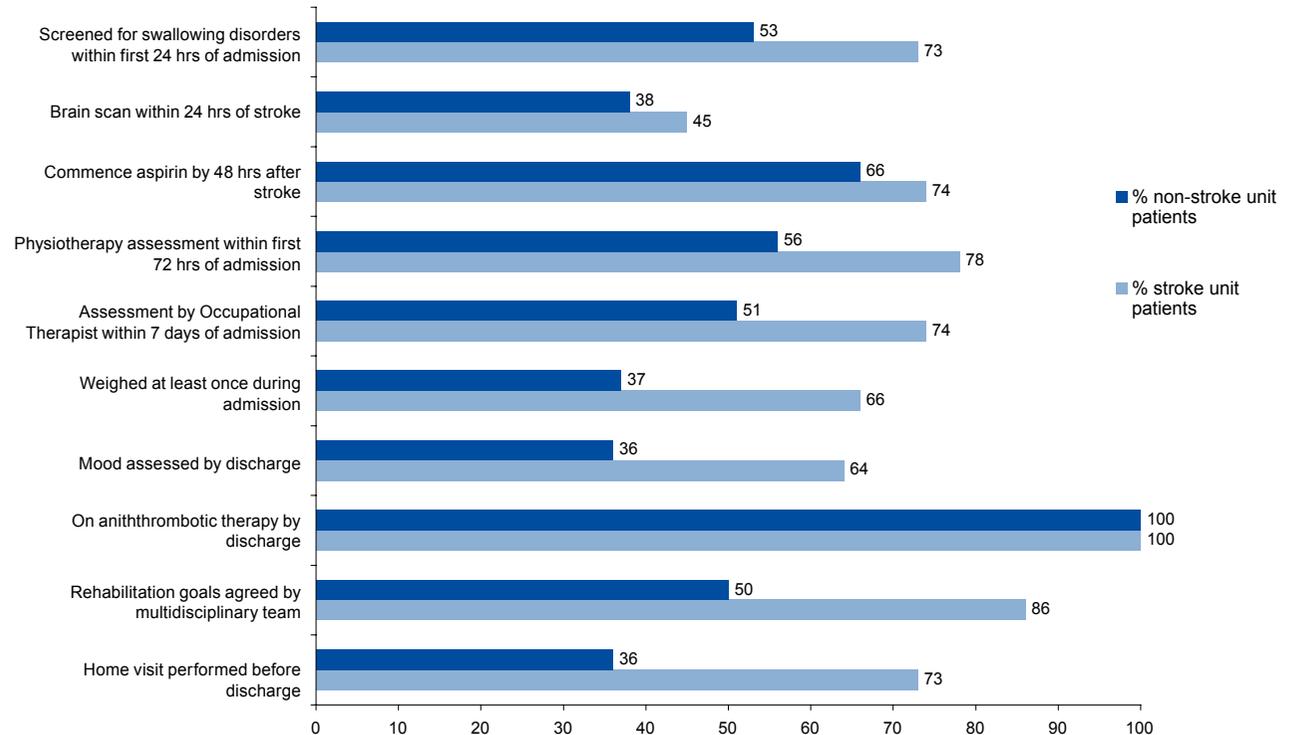
Note: change in level of brain scanning in 24 hours may reflect changes in question

Source: Royal College of Physicians

Key process indicators: stroke units versus other wards

Stroke units provide high-dependency care including physiological and neurological monitoring, rapid treatment of stroke and associated complications, early rehabilitation and palliative care. There is strong evidence that stroke units reduce mortality and improve patient outcomes. This chart illustrates some of the ways in which stroke units differ from other wards in the delivery of key quality processes. Increased survival and better outcomes are strongly associated with processes of care such as early mobilisation, early feeding and measures to prevent aspiration.

Key process indicators, stroke units vs other wards, England, Wales and Northern Ireland, 2006

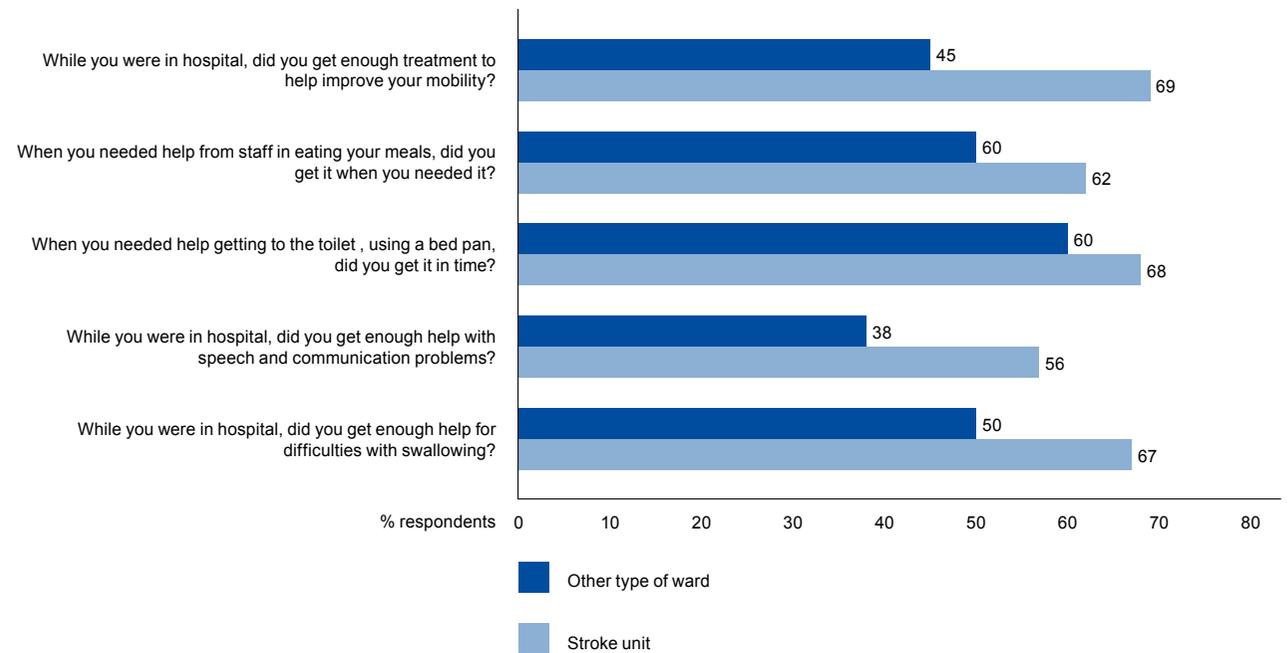


Source: Royal College of Physicians

Comparing specialist and general stroke wards: patient perspective

There is strong evidence that specialist stroke units deliver better outcomes. In the 2006 Sentinel Stroke Audit 64 per cent of English patients were admitted to a stroke unit at some point; 56 per cent spent more than half of their treatment time in a stroke unit. This chart provides the patients' perspective on the differences between stroke units and other wards. It displays data from the Healthcare Commission's 2005 survey of stroke patients. It shows that for a number of aspects of care there were statistically significant differences in the standards provided in specialised stroke units compared with other types of wards.

Quality of stroke care: stroke unit versus other wards, England, 2005

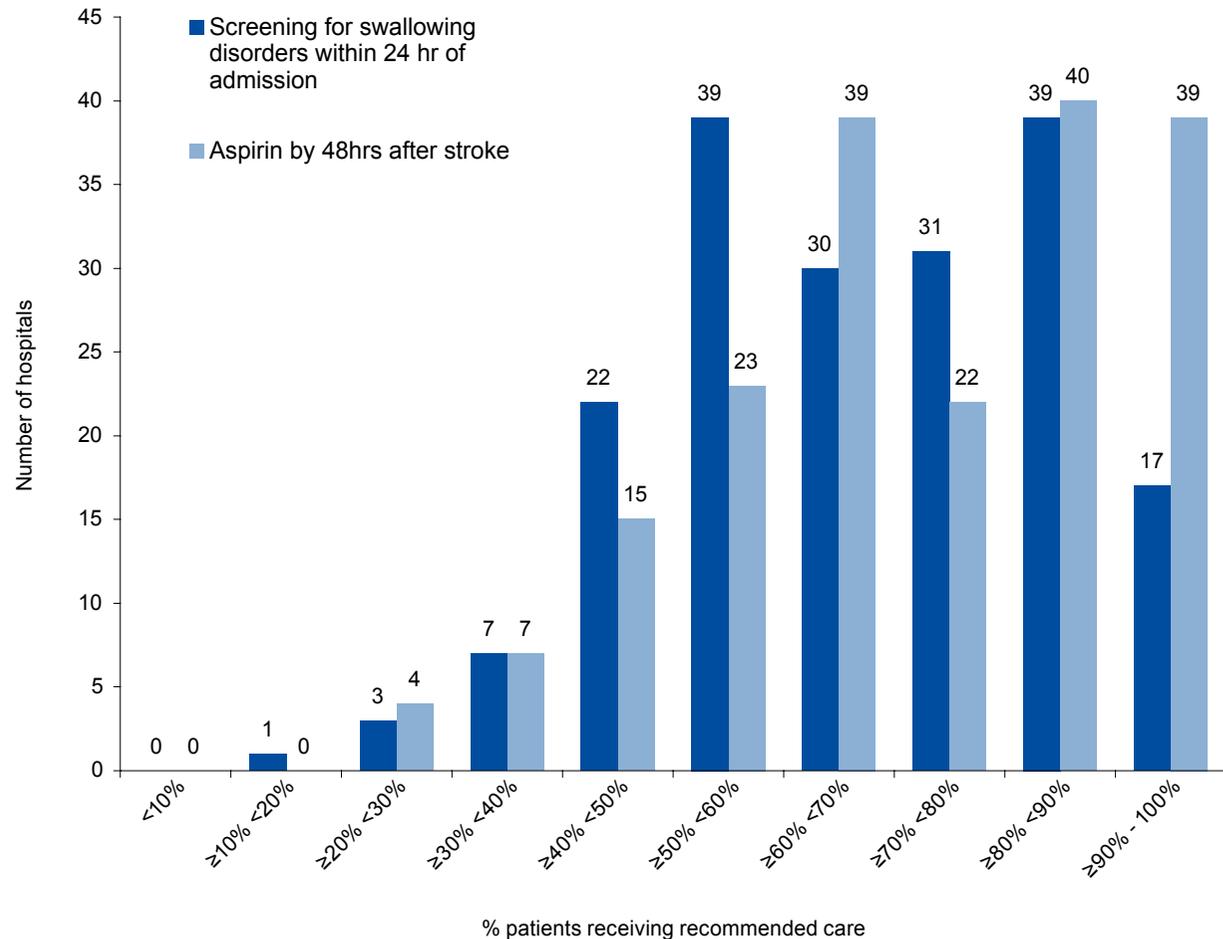


Source: Healthcare Commission

Variation within key indicators of effectiveness: acute care

The Sentinel Stroke Audit collects process data retrospectively from patient records. The chart on page 26 shows achievement levels across England for 12 key indicators. The chart shows the level of variation within England for 2 of those 12 indicators: the proportion of patients that are screened for swallowing disorders within 24 hours of admission, and the proportion given aspirin within 48 hours of their stroke (variation in scanning is shown on page 41). For screening for swallowing disorders, 1 hospital reported that fewer than 20 per cent of its patients were screened; at the other end of the spectrum, 17 hospitals reported that over 90 per cent of their patients were screened (with 1 hospital reporting 100 per cent). For aspirin, results were generally better: no hospitals reported that fewer than 20 per cent of patients were given aspirin, and 39 hospitals reported that over 90 per cent of their patients were given aspirin (with 5 hospitals reporting 100 per cent).

Variation in key acute care indicators, hospital histograms, England, 2006



Source: Royal College of Physicians

Thrombolysis after stroke

Thrombolysis has the potential to improve outcomes for patients with cerebral ischaemia; however, it is a high-risk treatment. Evidence from Phase IV studies has shown that without strict adherence to clinical protocols thrombolysis can put patients at risk of poorer health outcomes. The National Clinical Guidelines for Stroke (RCP, 2004) recommend that thrombolytic treatment be given following an ischaemic stroke if:

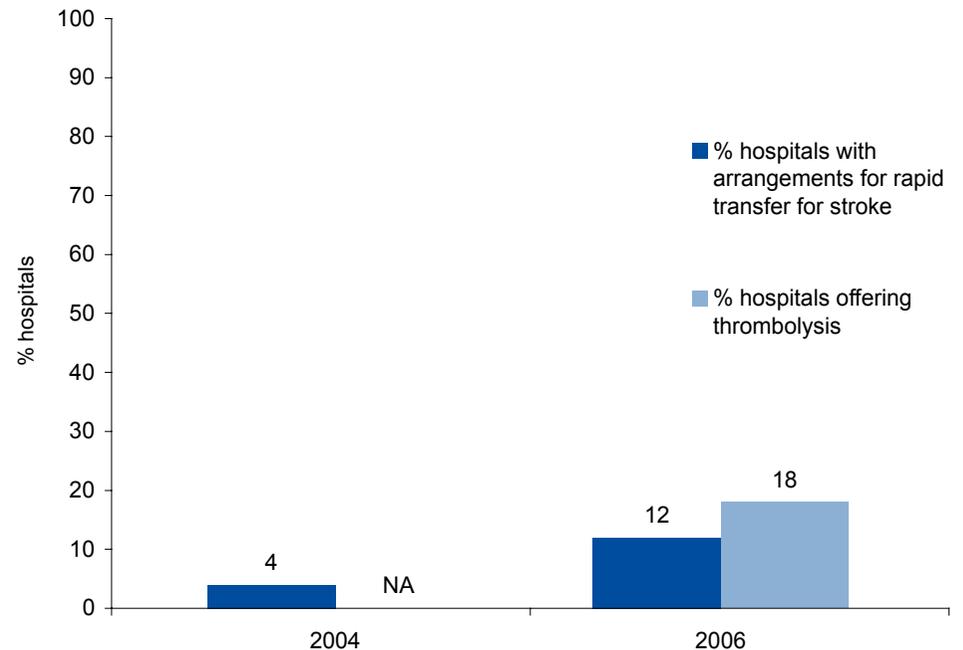
- it is administered within three hours of onset of symptoms
- haemorrhage has been definitively excluded
- the patient is in a centre registered with the Safe Implementation of Thrombolysis in Stroke Monitoring Study.

This chart is based on the biennial Sentinel Stroke Audit. It shows that in 2006:

- only 12 per cent of hospitals had adequate arrangements with local ambulance services for emergency transfer to hospital
- only 18 per cent (40/226) of hospitals offered a thrombolysis service
- 10 of the 40 sites (25 per cent) with capabilities for thrombolysis did not thrombolyse any patients
- only 218 (0.2 per cent) of patients were thrombolysed over a 12-month period (data not shown), a tiny proportion of the patients who would potentially benefit.

The audit noted that the failure to develop arrangements with paramedic services to urgently transport patients with stroke to hospital reflects the slow progress that has been made in the development of thrombolysis services in the UK.

Emergency treatment for stroke, England, Wales and Northern Ireland, 2004 and 2006



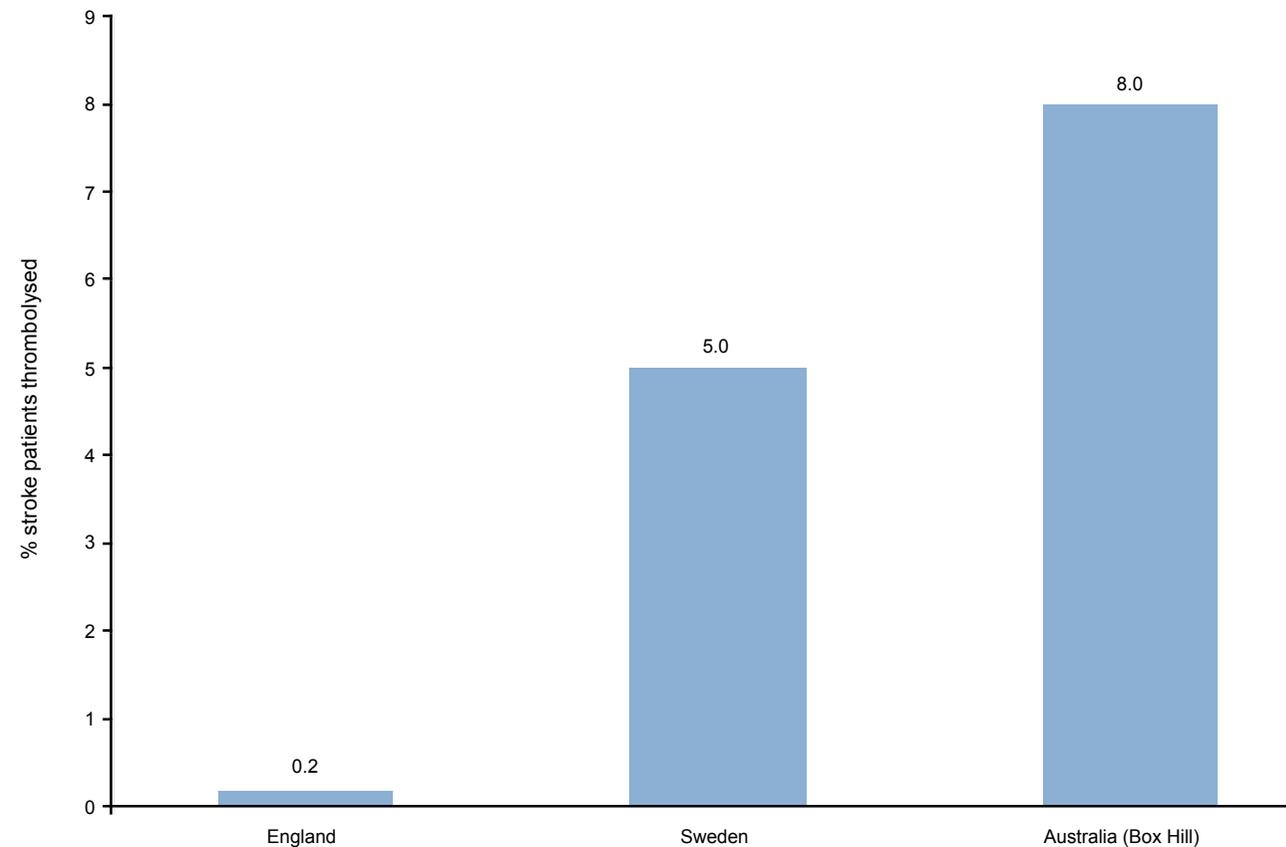
Note: rt-PA was licensed under the brand name Actilyse for use in acute ischaemic stroke in April 2003 in the UK. It must be administered within a three-hour time window and was launched under strict licensing guidelines.

Source: Royal College of Physicians

Thrombolysis rates: international centres of excellence

The low thrombolysis rates reported by the Sentinel Stroke Audit can be placed in context by comparing performance to other healthcare systems. The chart provides information on the potential for improvement, illustrating that thrombolysis rates in England lag behind international centres of excellence where rates of up to 8 per cent of all stroke patients have been reported.

Thrombolysis rates – international comparison

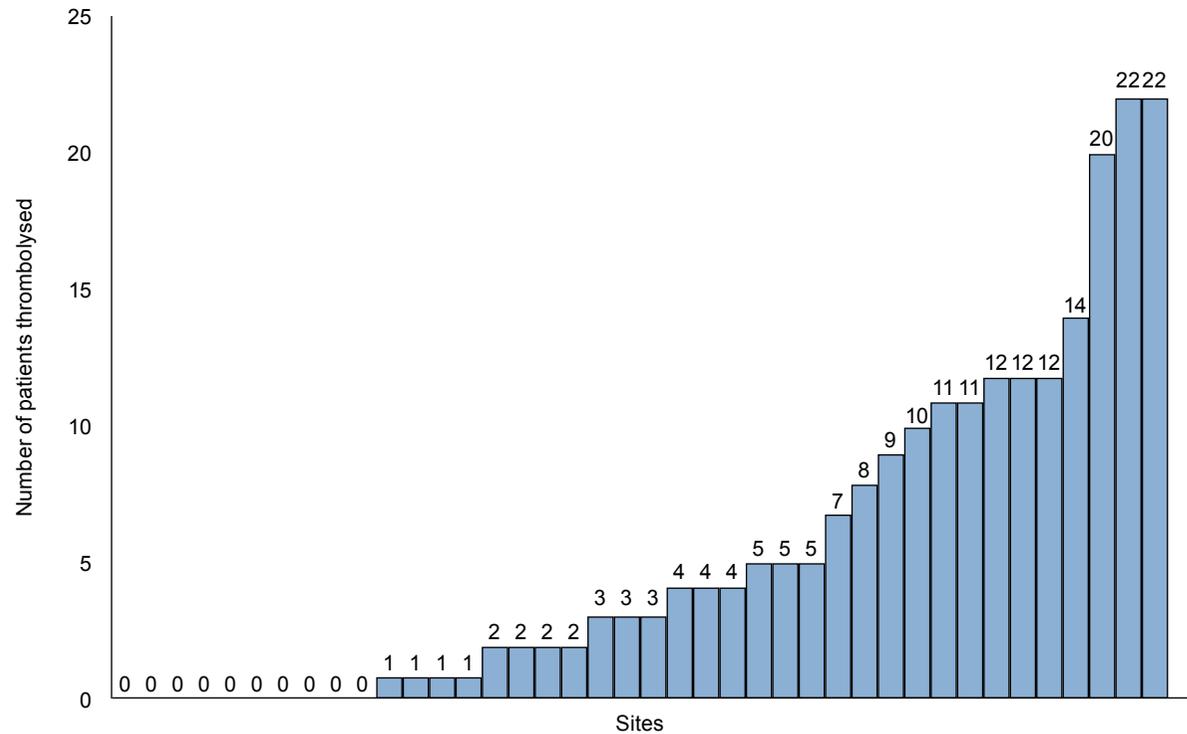


Source: NAO, 2007; Bray *et al*, 2006

Thrombolysis delivery in England: variation

The 2006 Sentinel Stroke Audit found that 18 per cent of hospitals (40/226) offered a thrombolysis service to stroke patients. The chart shows that 218 patients were thrombolysed – less than 0.2 per cent of all stroke patients. This should be interpreted in the light of thrombolysis rates achieved in some stroke units in Australia where up to 15 per cent of ischaemic stroke patients receive thrombolysis (NAO, 2007).

Stroke patients thrombolysed during the past 12 months at those sites who state they offer thrombolysis



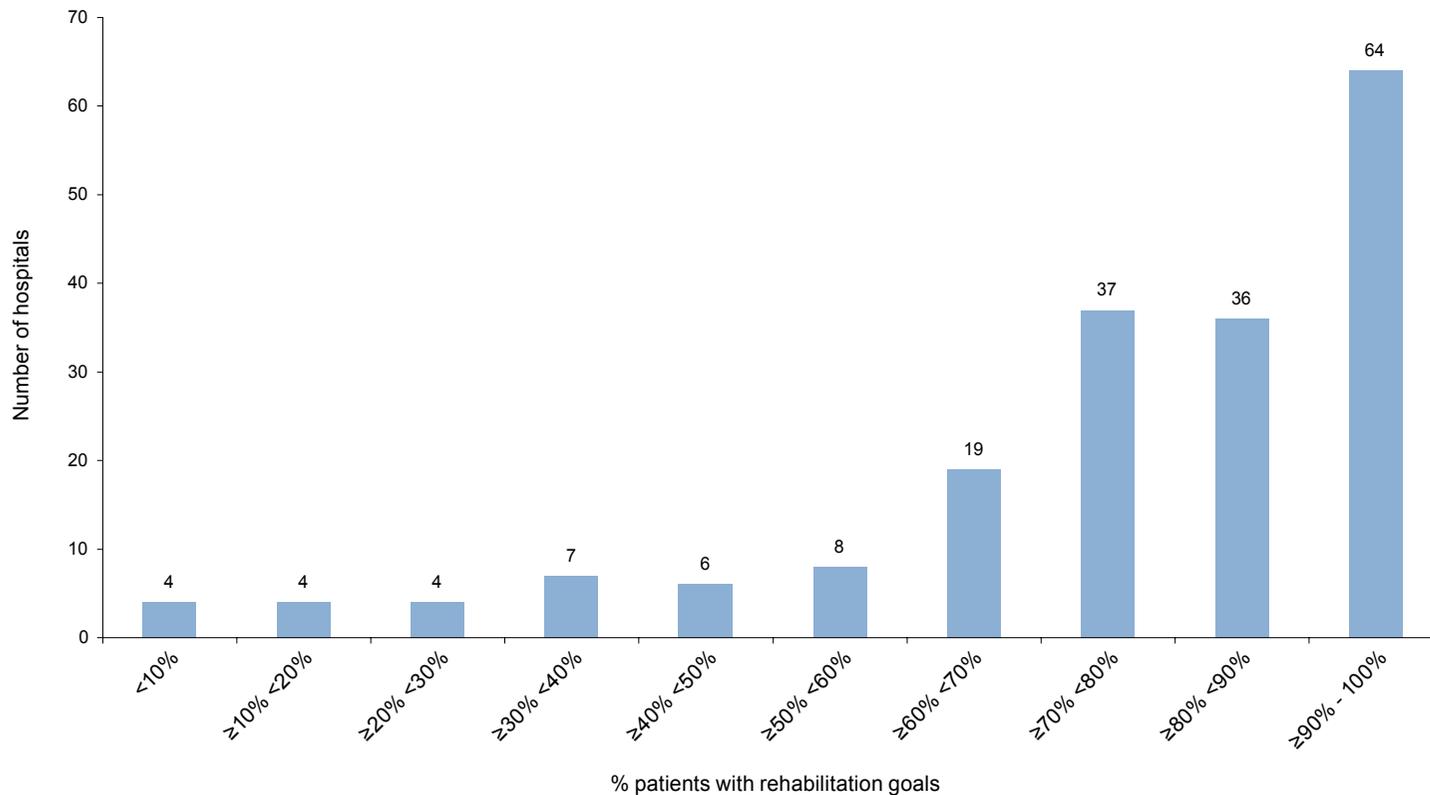
Source: Royal College of Physicians

Variation within key effectiveness indicators: rehabilitation

Much of stroke rehabilitation aims, directly or indirectly, to increase independence and ability in all activities of daily living (ADL): personal (for example, dressing), domestic (such as cooking) and communal (such as shopping). It has been shown that organised rehabilitation directly improves the ability of patients to perform ADLs. Out of a total of 189 hospitals, 4

reported that fewer than 10 per cent of their patients had rehabilitation goals agreed by multidisciplinary teams, while 64 hospitals reported that over 90 per cent of their patient had these goals. Twenty hospitals reported complete compliance, that is, all audited patients had rehabilitation goals.

Rehabilitation goals agreed by multidisciplinary team, hospital histograms, England, 2006

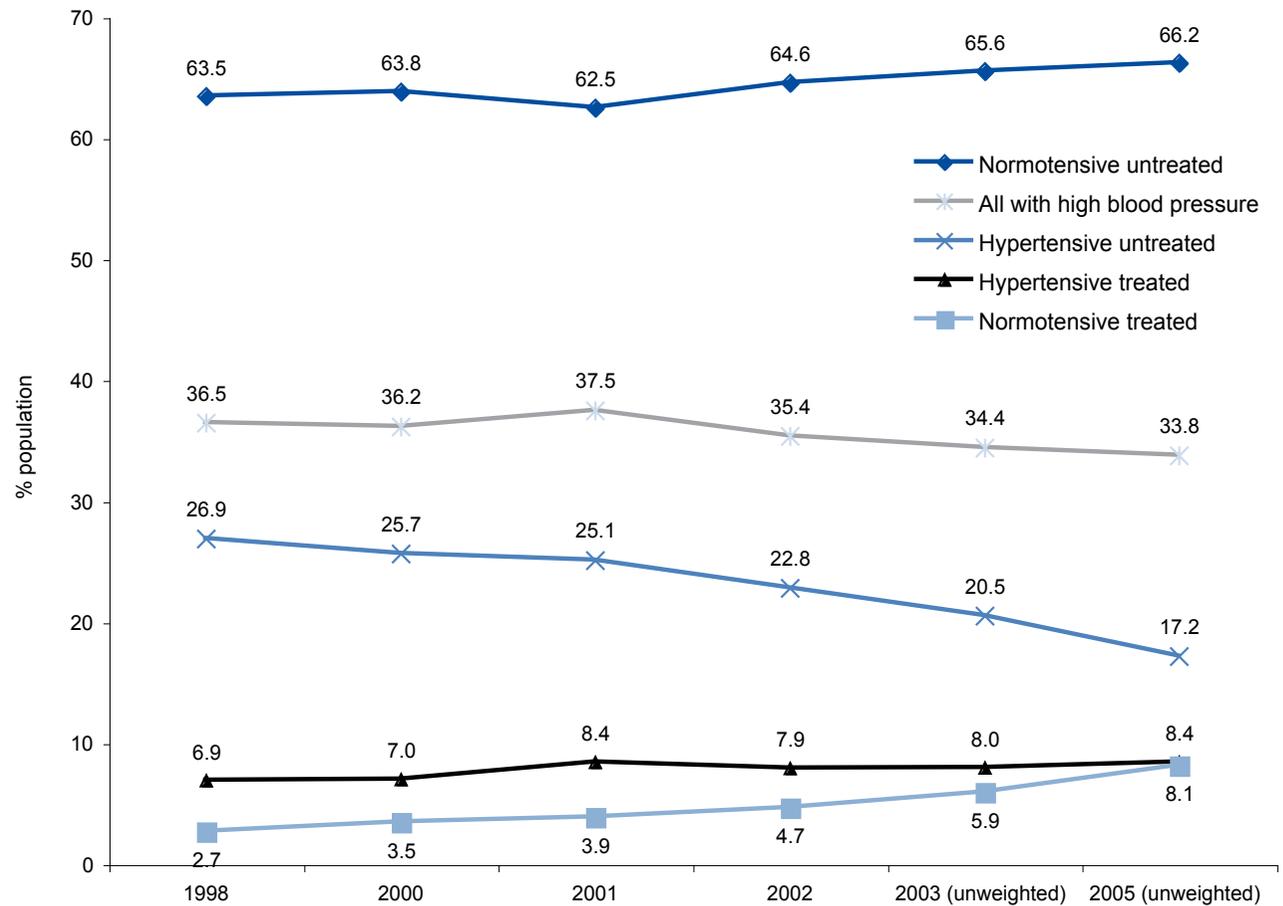


Source: Royal College of Physicians

Prevention: blood pressure control

The Health Survey for England is conducted every year and provides data on health and health-related behaviours in adults and children. The survey focuses on a different demographic group each year and looks at health indicators such as cardiovascular disease, physical activity, eating habits, oral health and accidents. The chart shows the data available on blood pressure control in England and shows that the percentage of people with untreated hypertension decreased by 9.7 per cent between 1999 and 2005. Despite this improvement, it is of concern that 17.2 per cent of people have untreated hypertension.

Blood pressure level, England, 1999-2005



Note: In the 1998 report the systolic blood pressure and diastolic blood pressure thresholds for hypertension changed from 160/95 to 140/90 mmHg, in accordance with the latest guidelines on hypertension management. Informants were placed in one of the treated categories if they were currently taking a drug prescribed for high blood pressure whereas previously they had been described as treated if they were prescribed any drug which had the effect of lowering their blood pressure.

Source: NHS Information Centre, www.ic.nhs.uk/webfiles/publications/hseupdate05/HSE2005TrendTables.xls

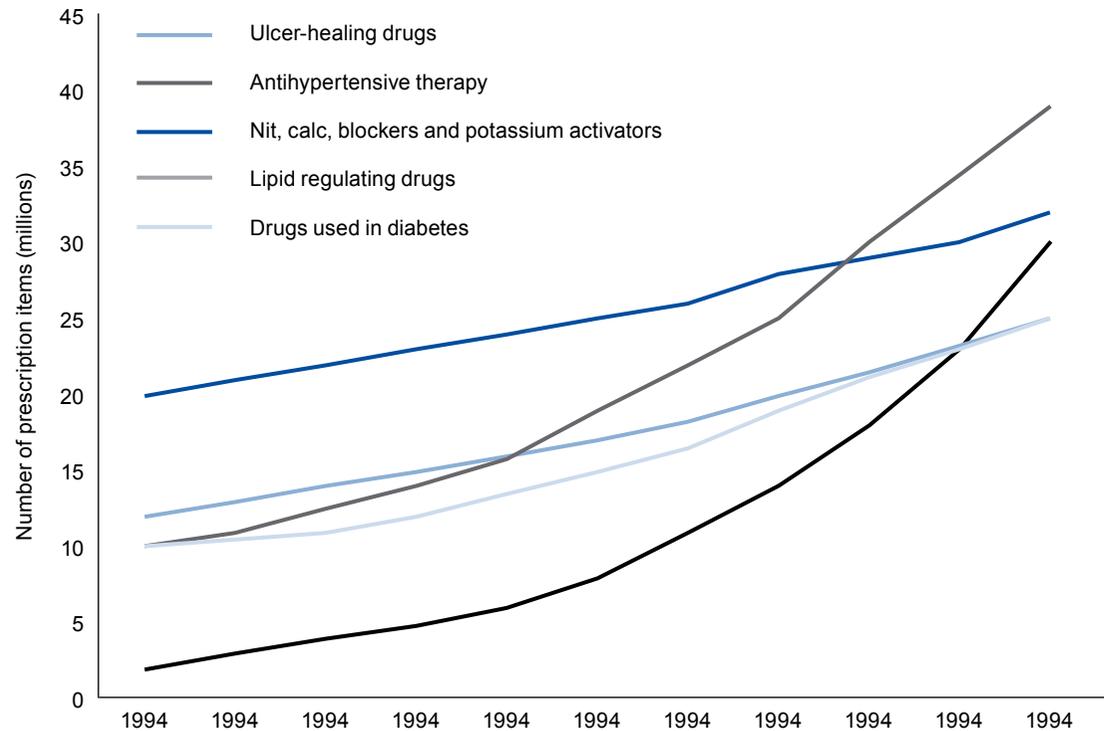
Prevention: statin and hypertensive prescribing

This chart illustrates the number of prescriptions dispensed by community pharmacists, appliance contractors and dispensing doctors, and prescriptions for items personally administered over the period 1994-2004.

Lipid-regulating drugs had an increase in net ingredient cost of £54.2 million to £769.2 million in 2004; the number of prescription items increased by 30 per cent. The average net ingredient cost per item decreased by 17.2 per cent. This is due to the recent expiry of the patents for Simvastatin in May 2003 and Pravastatin in August 2004.

The net ingredient cost of antihypertensive drugs was £610 million in 2004. This was an increase of £34.2 million over 2003. The number of prescription items dispensed increased from 33.8 million in 2003 to 38.6 million in 2004.

Ten-year trends in number of prescription items dispensed for the five BNF sections which had the greatest net ingredient cost in 2004

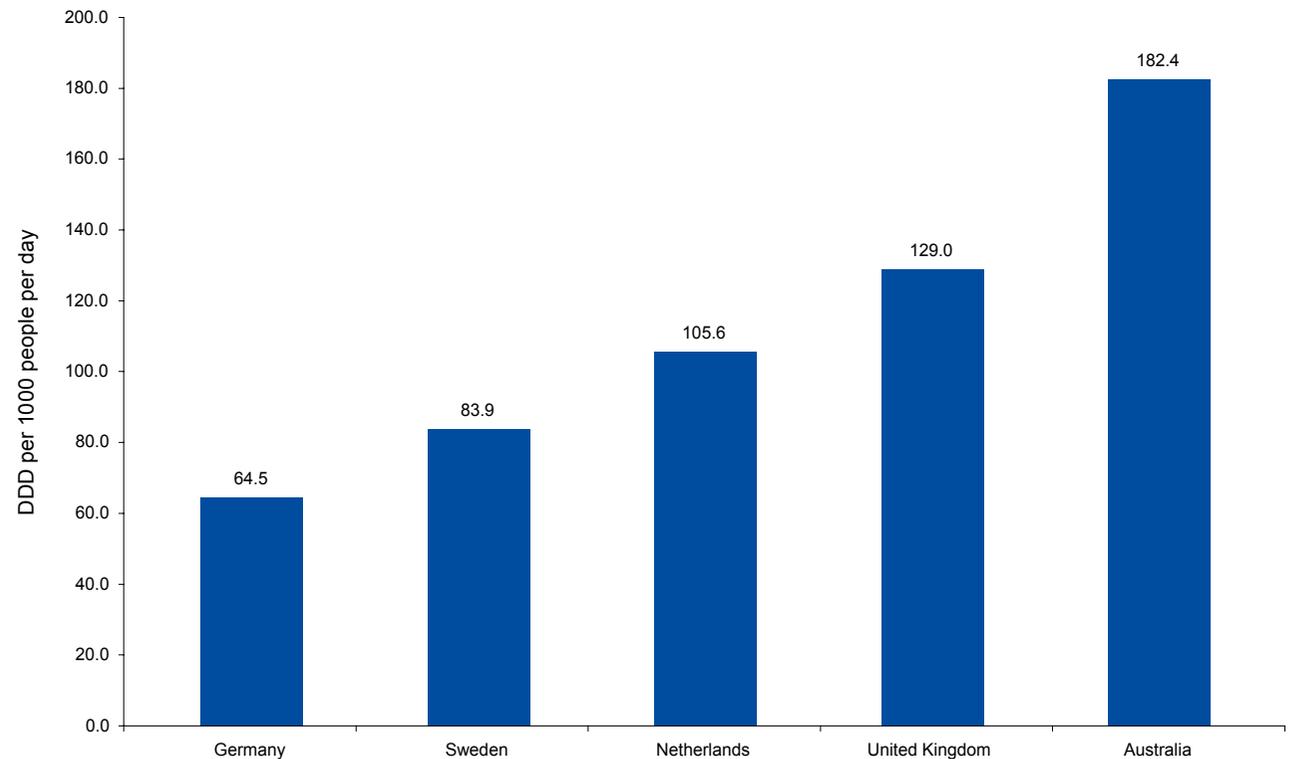


Source: NHS Information Centre www.ic.nhs.uk/webfiles/publications/prescriptionsdispensed05/PrescriptionsDispensedCommunity290705_PDF.pdf

Prevention: lipid-modifying agents prescribing

Lipid-modifying agents, usually referred to as statins, significantly reduce the risk of stroke in those with coronary artery disease and elevated total or low-density lipoprotein cholesterol (LDL-C). Meta-analysis has shown that each 10 per cent reduction in LDL-C corresponds to a risk reduction of all stroke of 16 per cent (95 per cent; confidence interval 6.7 to 24) (Amarengo *et al*, 2004). This chart shows comparative prescribing rates across five countries in 2005.

Statins, defined daily doses per 1000 inhabitants per day, international comparison, 2005

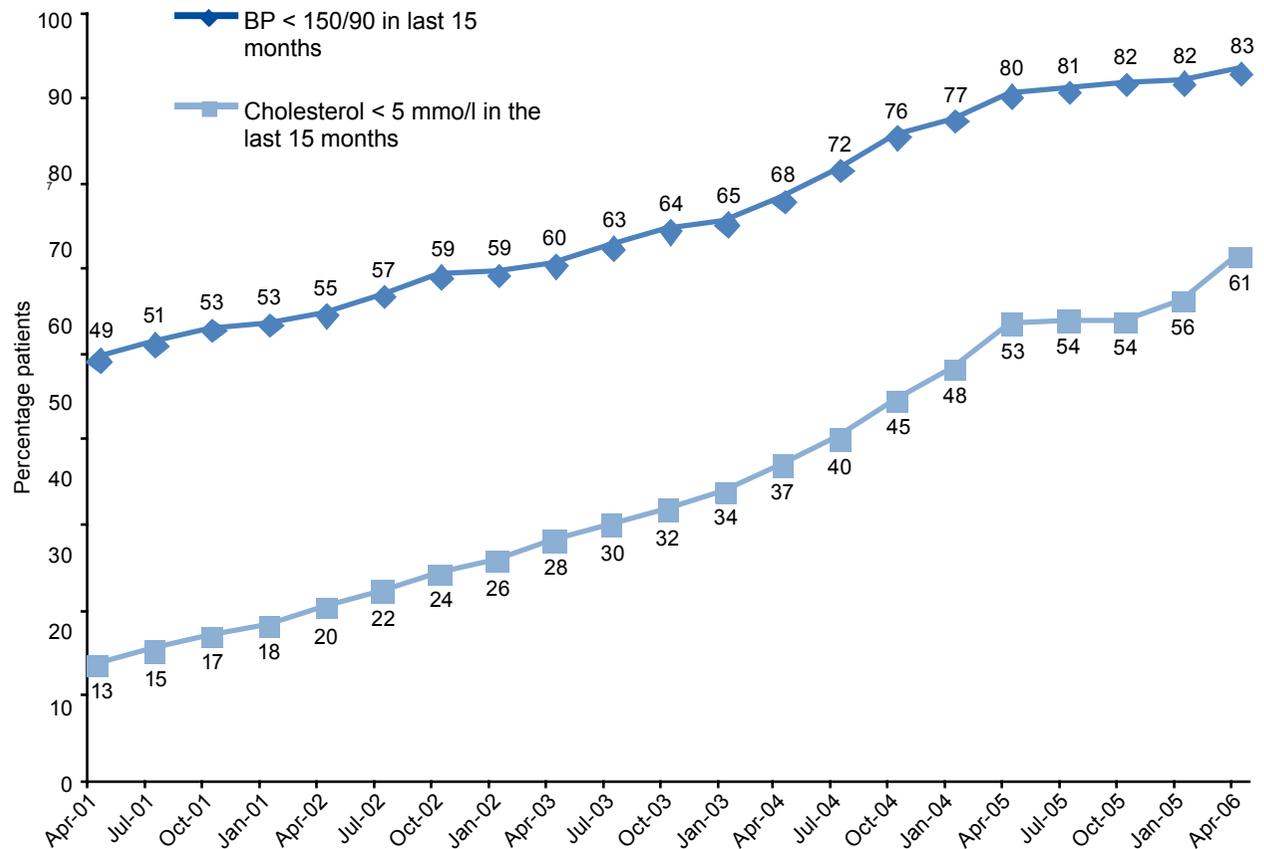


Source: OECD, 2007

Prevention: quality outcomes framework indicators for stroke

This chart illustrates findings from a large analysis of records from 498 general practices in England (overall registered population 3.4 million) conducted by QRESEARCH, a large consolidated database of general practice clinical records. It shows changes in preventive care indicators before and after the introduction of the Quality and Outcomes Framework (QOF) in 2005. Over a five year period, there has been a significant increase in the number of patients with their cholesterol under control. In April 2001, 13 per cent of patients had a cholesterol level of <5 mmol/l; in April 2006 this figure had increased to 61 per cent. Over the same time period, the percentage of stroke patients with their blood pressure under control at <150/90mmHg increased from 49 per cent in 2001 to 83 per cent in 2006.

Percentage stroke patients achieving QOF indicators, England, 2001-2006

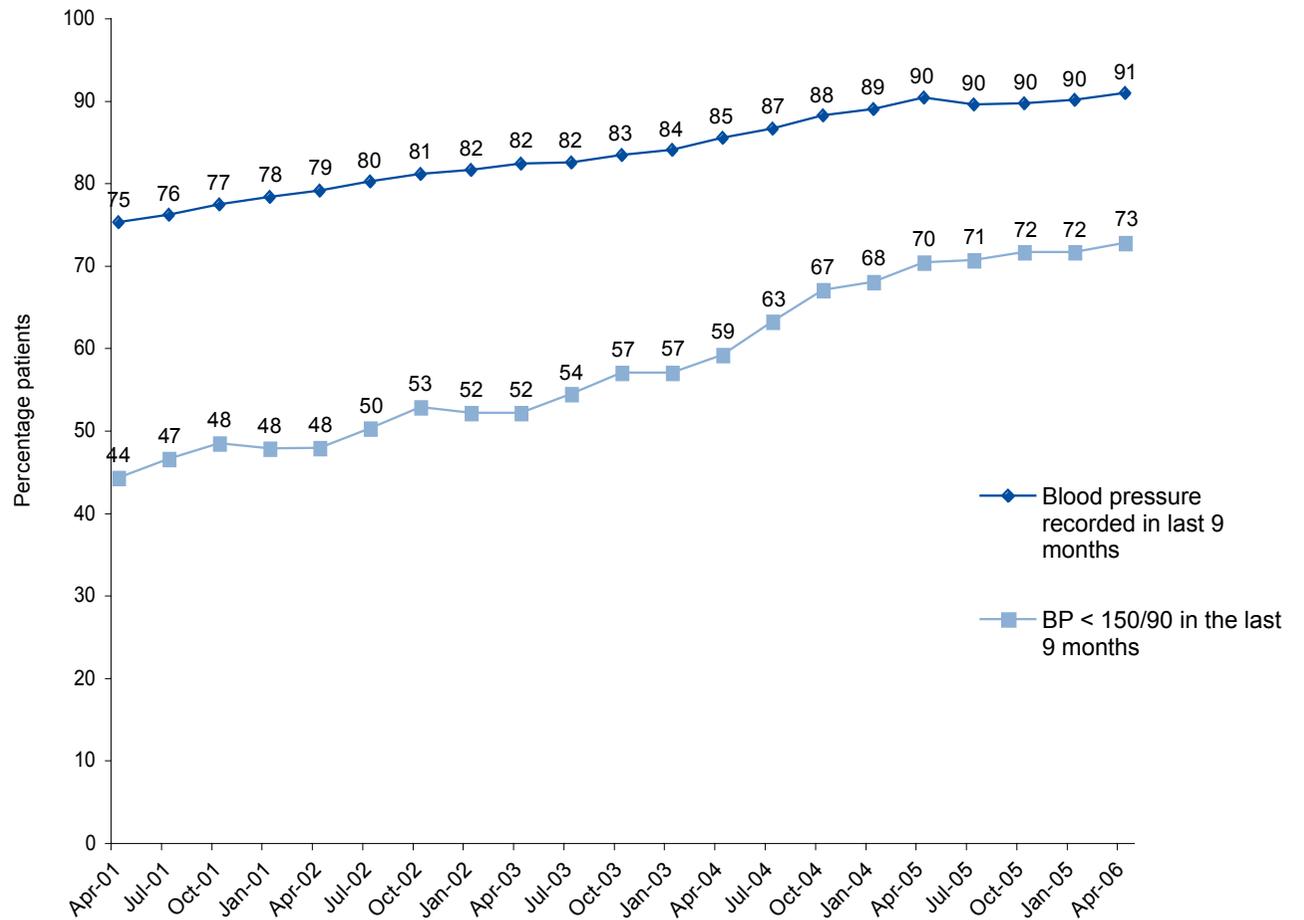


Source: Hippisley-Cox *et al*, 2007

Prevention: quality outcomes framework indicators for hypertension

Based on QRESEARCH findings, the chart illustrates that recording of blood pressure in hypertensive patients in the previous 9 months increased from 75 per cent in April 2001 to 91 per cent by April 2006. Over the same time period the percentage of patients with controlled blood pressure levels increased from 44 to 73 per cent.

Percentage hypertension patients achieving QOF indicators, England, 2001-2006



Source: Hippisley-Cox *et al*, 2007

Access

The issue of access to healthcare has historically been a significant health policy concern. In England, recent years have been marked by a concerted effort to address excessive waiting lists, largely through supply-side interventions such as introducing waiting time targets, increasing system capacity and designing incentives for institutional and individual healthcare providers to increase access and throughput. These efforts have successfully brought about marked improvements in waiting times.

The National Stroke Strategy emphasises the need for:

- immediate referral for appropriately urgent specialist assessment and consideration of an investigation in all patients presenting with a recent TIA or minor stroke
- a system which identifies urgent and priority patients (those with early risk of potentially preventable full stroke) and assesses high-risk cases within 24 hours
- provision of brain imaging within 24 hours and carotid intervention, echocardiography and ECG within 48 hours where clinically indicated.

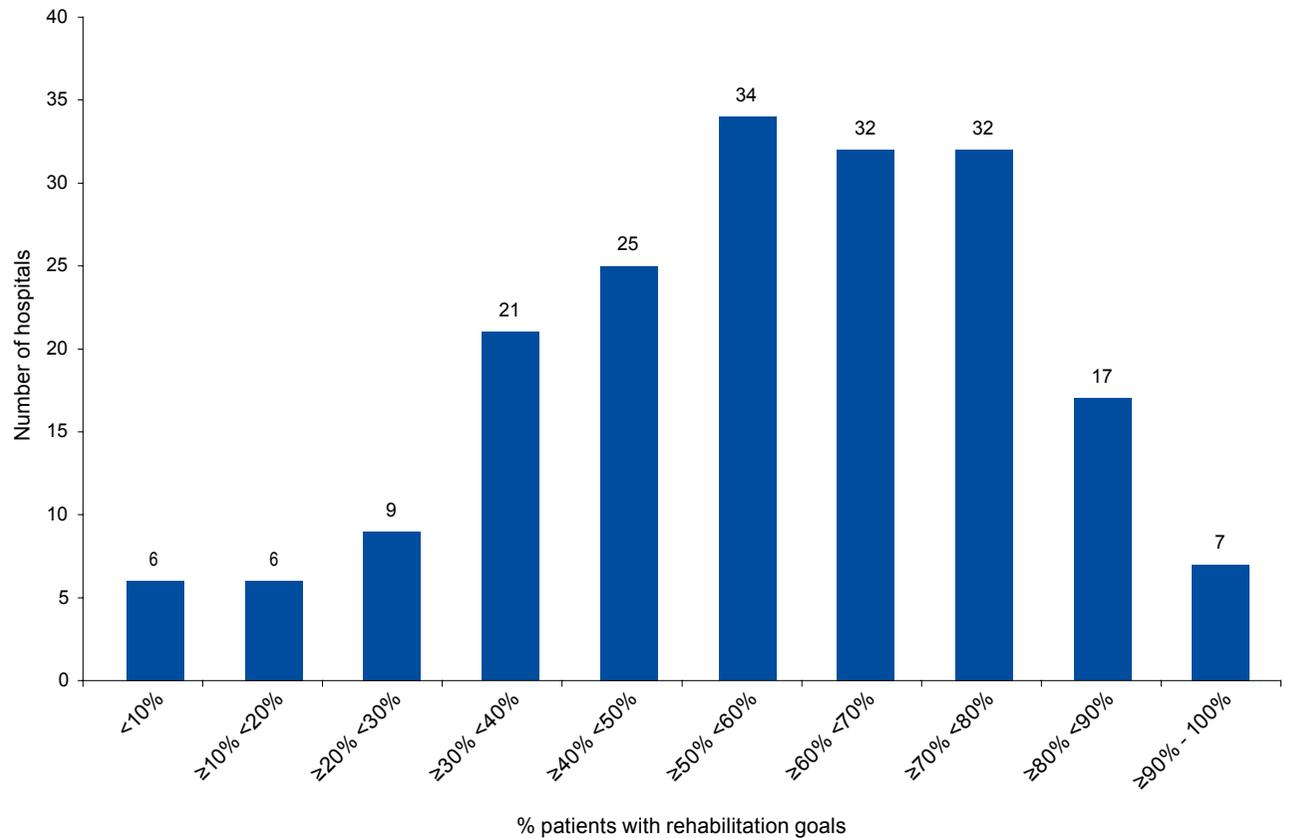
The data in this section illustrates the current situation regarding access to:

- stroke units
- diagnostic scans
- rapid assessment of TIA
- rehabilitation services.

Access to stroke wards: variation

The evidence that being cared for in a stroke unit reduces mortality and increases the number of survivors who are independent and non-institutionalised is extremely strong. The 2006 Sentinel Stroke Audit found that, across England, 56 per cent of stroke patients spent more than half of their stay in a stroke unit. It has been estimated that if access to stroke units was increased to 75 per cent of patients over 500 deaths could be avoided, and the number of independent survivors would increase by 200 (Department of Health, 2008). This chart illustrates the variation across 189 hospitals in England for this indicator. At the extremes, 6 hospitals reported that less than 10 per cent of their patients spent more than half their stay on a dedicated stroke unit while 7 hospitals reported that more than 90 per cent of their patients did so.

Proportion of patients treated for more than half their stay on stroke unit, England, 2006

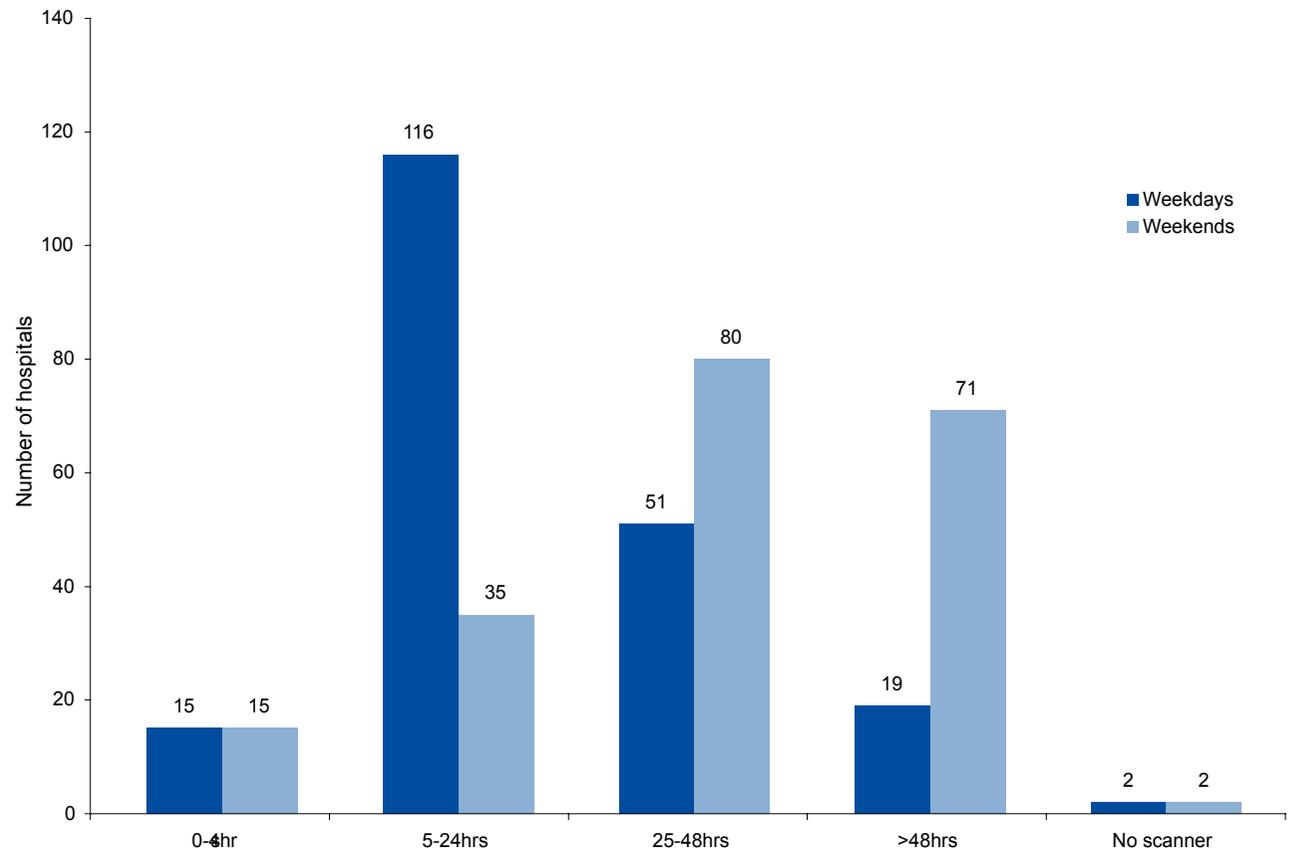


Source: Royal College of Physicians

Access to CT scanners: variation across England

The National Stroke Strategy (2007) recommends that acute stroke patients are scanned in the next scan slot within usual working hours, and within 60 minutes of an out-of-hours request. Data from the 2006 Sentinel Stroke Audit shows that there is a wide variation in waits for CT (computed tomography) scans. The chart illustrates the distribution of average waits and demarcates between weekdays and weekends. Out of 203 hospitals in England, only 15 (7 per cent) had an average wait for a CT scan of between 0 and 4 hours. Average waits were significantly longer at weekends when 151 hospitals had average waits of over 24 hours (74 per cent).

CT scan average waits, hospital histogram, England, 2006



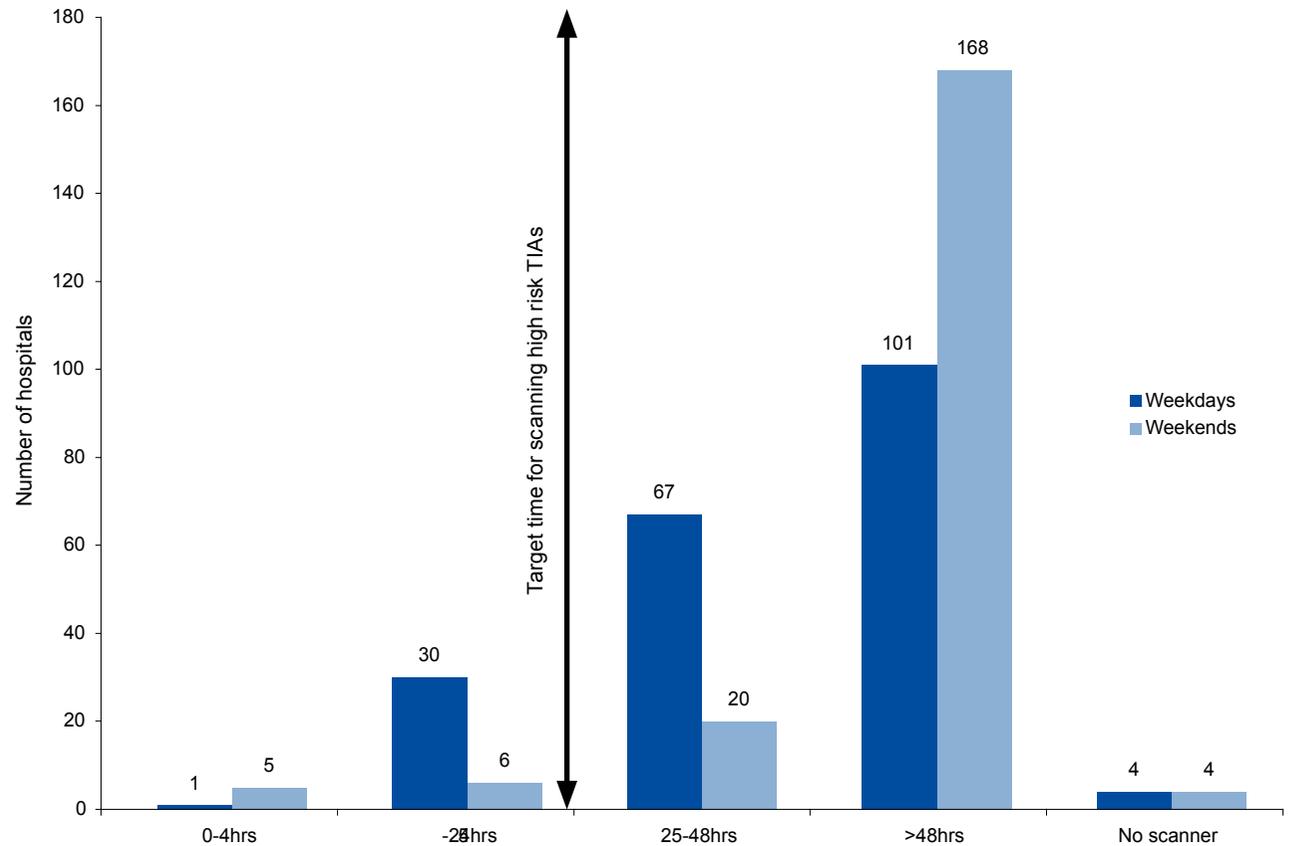
Note: Prior to the release of the *National Stroke Strategy*, the *National Clinical Guidelines for Stroke* (RCP, 2004) recommended scanning within 24 hours of the onset of symptoms of stroke to confirm diagnosis (and so this is the standard against which performance should be judged).

Source: Royal College of Physicians

Access to MRI scanners: variation across England

High-quality imaging of the brain and blood vessels is a key part of a successful stroke service. Currently, CT scans are sufficient to determine whether a stroke is due to a clot or a bleed, but the higher spatial resolution of magnetic resonance imaging (MRI) is better for determining whether the diagnosis for TIA is correct and how large any infarction may be (Chalela *et al*, 2007; Department of Health, 2007). This chart illustrates the average waits for MRI scans. Out of 203 hospitals in England, only 31 (15 per cent) have average weekday waits for MRI scans of 24 hours or less. Waits are considerably longer on weekends, with 168 hospitals (83 per cent) reporting an average wait of over 48 hours.

MRI scan average waits, hospital histogram, England, 2006



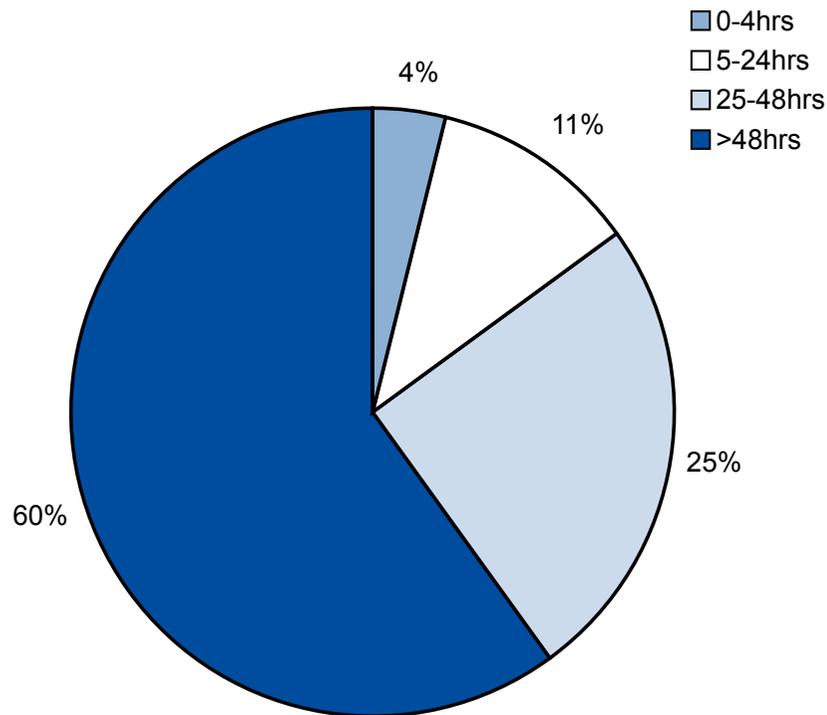
Source: Royal College of Physicians

Access to carotid doppler scans

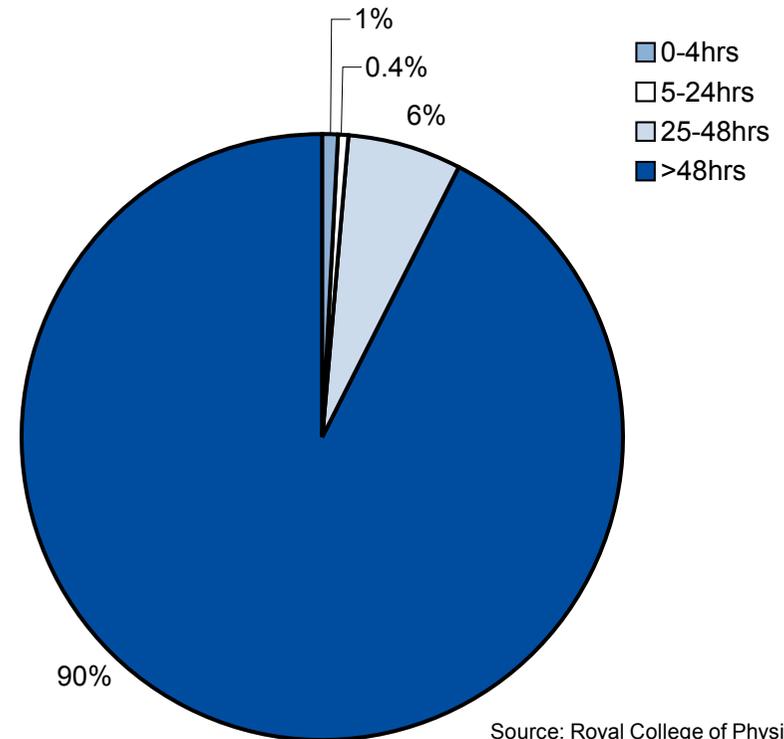
Around 150,000 people per year have a suspected TIA or minor stroke, but currently only 37 per cent are seen and investigated in a neurovascular clinic within seven days (see page 44). There is a 20 per cent risk of a full stroke within the first four weeks after a TIA. About 80 per cent of TIAs and minor strokes require scanning of the arteries around the throat, which provide the

blood supply to the brain. Carotid imaging should ideally be performed at initial assessment and should not be delayed for more than 24 hours after first clinical assessment of patients with TIA or minor stroke patients at higher risk of stroke. The chart shows that the vast majority of patients are waiting longer than 24 hours, and access is very restricted at weekends.

Average waits for carotid doppler imaging, weekdays, England, Wales and Northern Ireland, 2006



Average waits for carotid doppler imaging, weekends, England, Wales and Northern Ireland, 2006

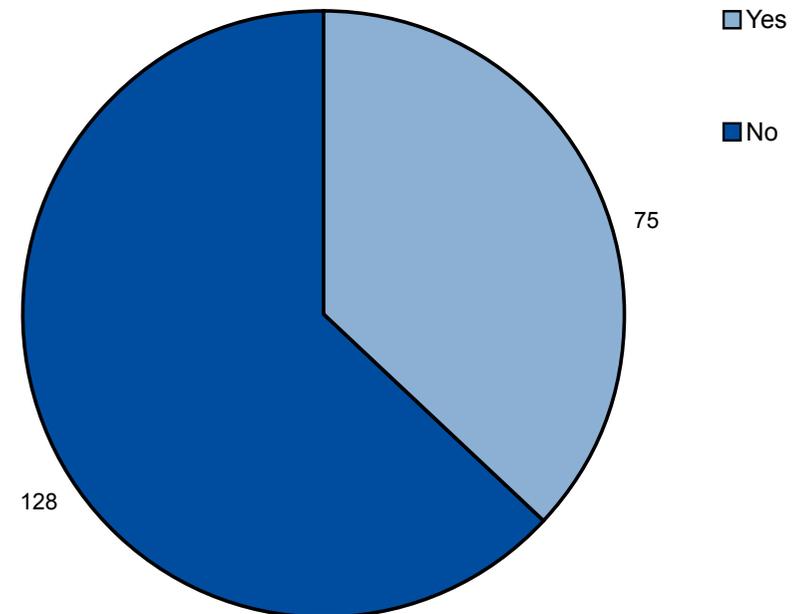


Source: Royal College of Physicians

Access to care following TIA

The risk of stroke within the first four weeks after TIA can be as high as 20 per cent. It is therefore vital that patients with TIA are seen urgently and investigated, and that a management plan is put in place. National Clinical Guidelines for Stroke (RCP, 2004) recommend that patients with TIA are seen in a neurovascular clinic within one week of the onset of symptoms. The Sentinel Stroke Audit found that 78 per cent of hospitals in 2006 had a neurovascular clinic (up from 65 per cent in 2004). The chart shows the proportion of hospitals reporting that TIA patients are seen and investigated within seven days. Almost two-thirds of hospitals indicated that they are not compliant with the guidelines.

TIA patients seen and investigated within 7 days, England, 2006



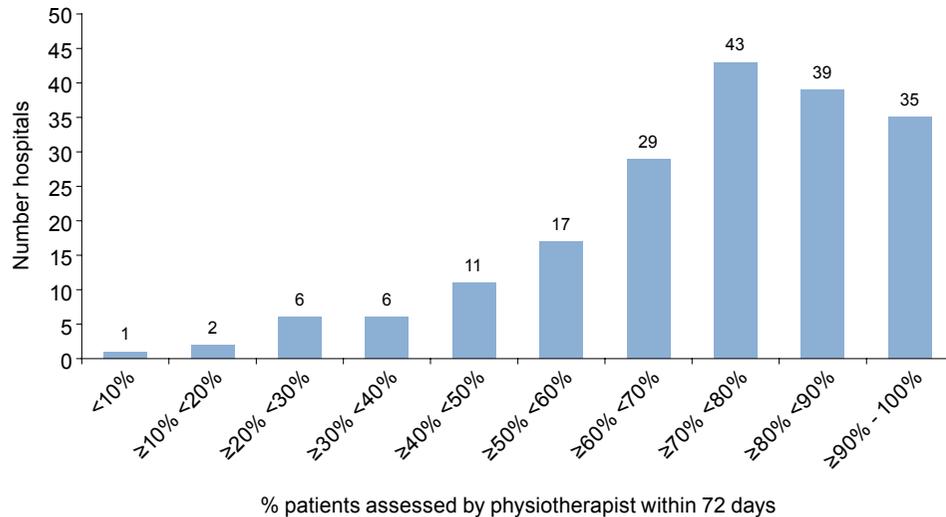
Source: Royal College of Physicians

Access to therapy: variation across England

The 2006 Sentinel Stroke Audit found that only around half of individuals who have experienced a stroke receive the rehabilitation to meet their needs in the first six months following discharge from hospital. This falls to around a fifth of patients in the subsequent six months. There are particular problems with patients getting timely access to therapists and social workers. As seen on page 26, a third of patients had not been assessed by a speech and language therapist within 72 hours of admission or 7 days for those with communication deficits, and 29 per cent of patients with motor problems had not seen a physiotherapist within 72 hours. Access to occupational therapy and social workers is even worse. These deficiencies have two implications

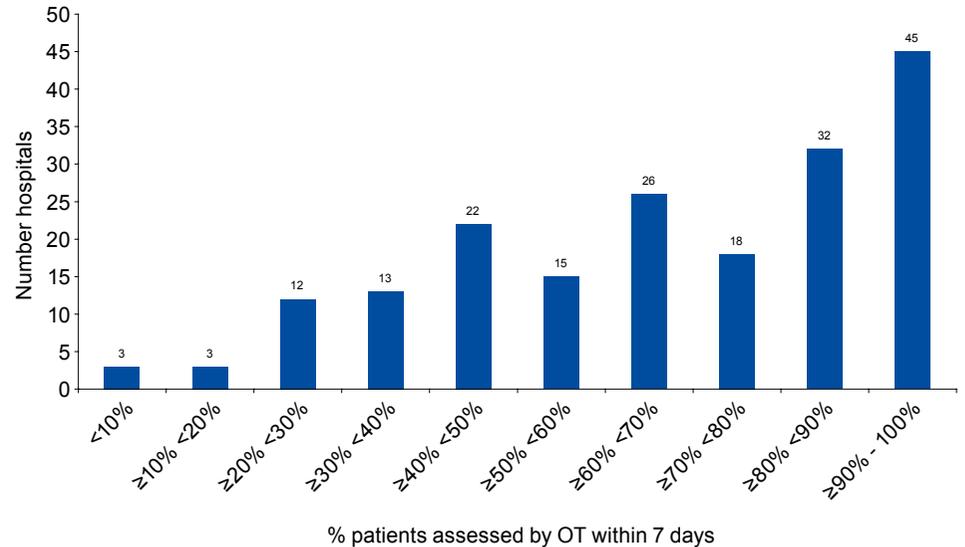
for quality: poorer patient outcomes and an increase in the time that patients spend in hospital. This chart provides a more detailed analysis of the data showing the extent of variation across England for physiotherapy and occupational therapy assessment. For physiotherapy the chart shows that in three hospitals fewer than 20 per cent of the patients were assessed within 72 hours of admission; at the other end of the spectrum, in 74 hospitals 80 per cent or more patients were assessed. For occupational therapy the results were more polarised, with 6 hospitals providing fewer than 20 per cent of patients with a timely service, while 77 hospitals provided a service in less than 7 days for 80 per cent or more of their patients

Physiotherapist assessment within 72 hours of admission, hospital histogram, England, 2006



Source: Royal College of Physicians

Occupational therapy assessment within 7 days of admission, hospital histogram, England, 2006



Source: Royal College of Physicians

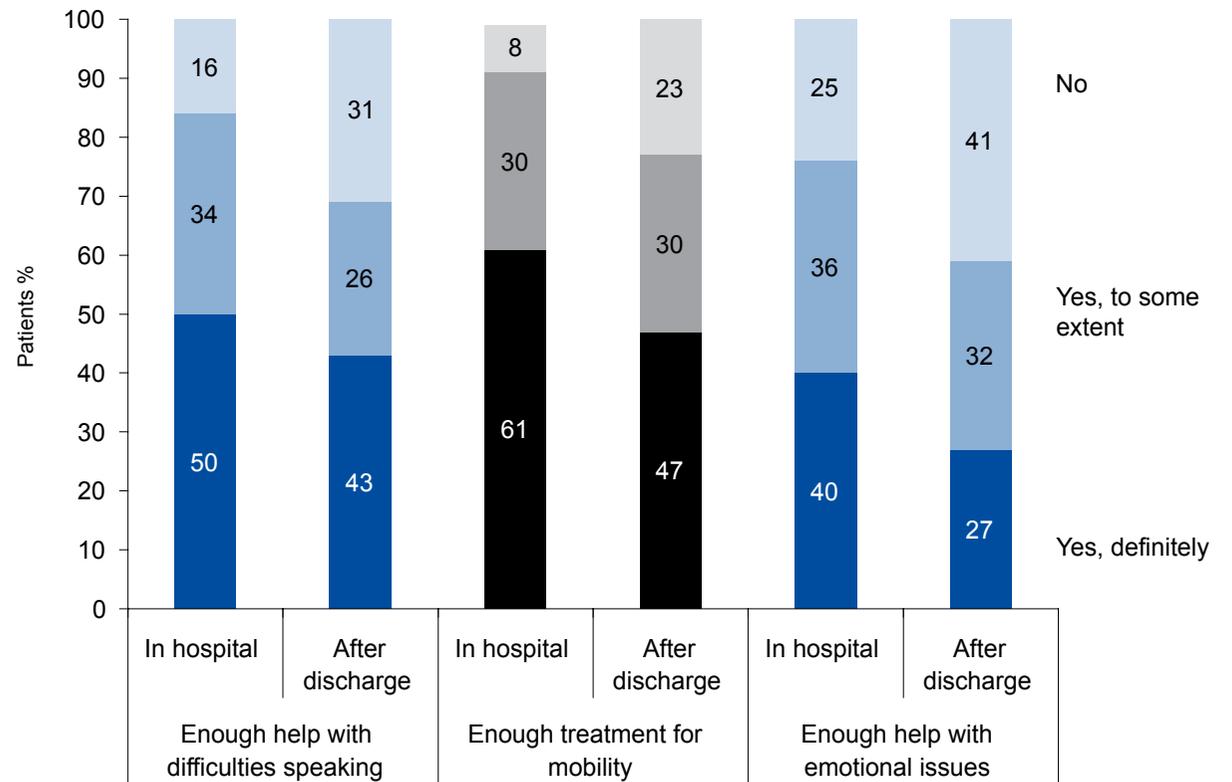
Stroke: rehabilitation in hospital and after discharge

Stroke can be a physically and emotionally debilitating event, often affecting a person’s mobility and his or her ability to communicate. The *National Service Framework for Older People* recommends that stroke patients participate, with their carers, in a multidisciplinary programme of secondary prevention and rehabilitation to address these problems (Department of Health, 2001). The Healthcare Commission’s 2005 patient survey asked the following questions of stroke patients about their time in hospital and after discharge:

- Did you get enough help with speech and communication problems?
- Did you get enough treatment to improve your mobility?
- Did you get enough help and support with any emotional issues that might be affecting you?

A significant minority of respondents said that they had not received enough help in hospital for speech and communication difficulties (16 per cent), mobility problems (8 per cent) or emotional issues (25 per cent). After they left hospital the percentage of patients who reported that they had not received enough help and support rose further. However, it is important to note that there is ongoing debate about the benefits of rehabilitation therapy in the longer term (Healthcare Commission, 2005).

Provision of stroke rehabilitation services – patient perspective, England, 2005



Source: Healthcare Commission

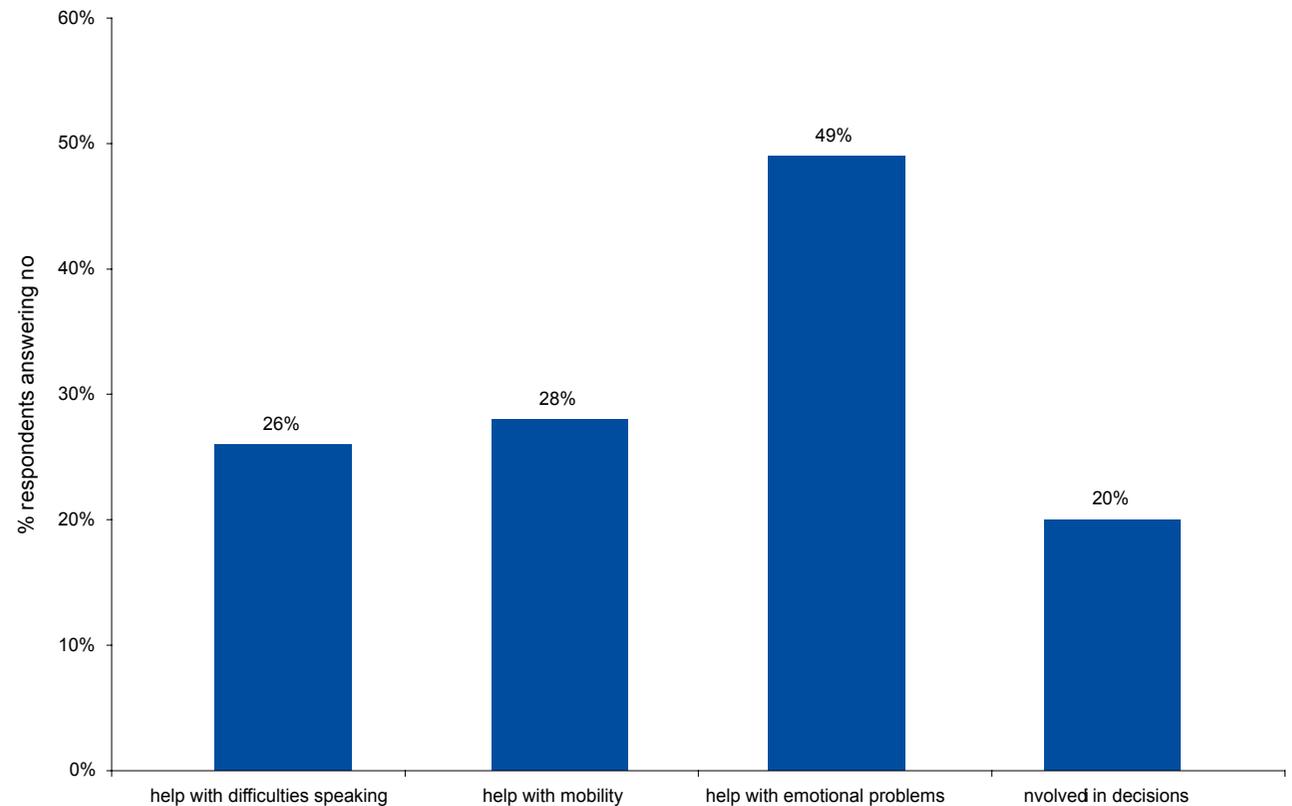
Stroke: delivery of long-term care

The 2005 Healthcare Commission survey of stroke patients (see page 46) was followed by a second survey of the same cohort to ascertain patient views on long-term care (2006). The survey asked patients since they had left hospital whether they had:

- enough help with difficulties with speaking from the NHS?
- enough treatment to help improve mobility (for example, walking, moving their legs) from the NHS?
- enough help with emotional problems (such as confusion, depression or crying) from the NHS?
- been involved as much as they wanted to be in decisions about the best medicine for them?

The chart illustrates the proportion of respondents answering 'no' to these questions.

Deficiencies in long term care of stroke, England, 2006



Source: Healthcare Commission

Capacity

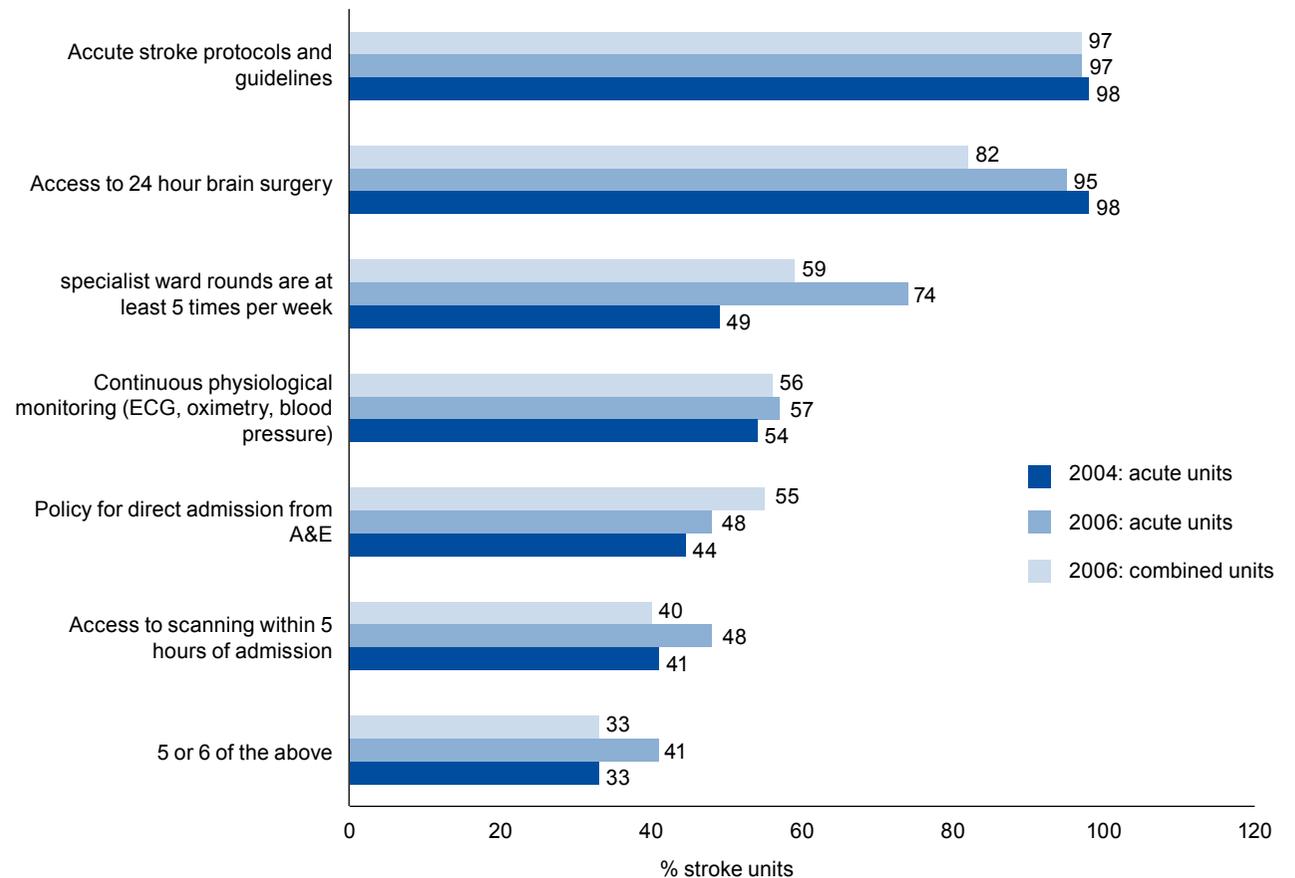
By the turn of the twenty-first century, sustained under-investment in the NHS was widely acknowledged to have taken its toll on quality of care. In response to these concerns the New Labour government announced in April 2002 a significant increase in funding for the NHS – representing an increase in the percentage of gross domestic product (GDP) spent on healthcare from 7.7 per cent in 2003 to 9.4 per cent in 2008 (Martin *et al*, 2006).

While the increased funding was initially widely welcomed, more recently there has been growing concern about whether the extra investment has secured good value for money. Further, there are services where capacity problems remain and where appropriate, skilled and equitably distributed resources do not match medical need. Stroke is one of these service areas.

Acute stroke units: facilities audit

Effective early management of stroke can reduce mortality and morbidity. Acute stroke care is generally more intensive with continuous monitoring and higher nurse staffing levels than rehabilitative care. Between 2004 and 2006, the proportion of hospitals with a stroke unit increased from 79 to 91 per cent. Of the 235 stroke units in England, Wales and Northern Ireland, 118 are acute units that admit patients immediately after they have suffered a stroke, but usually discharge patients within 7 days, and 63 are combined units that provide both acute and rehabilitative care. The features listed in the chart are all regarded as beneficial in acute stroke care. The chart shows the features available in acute stroke units in both 2004 and 2006, and in combined units in 2006. There have been some marked improvements in the care provided in acute units between 2004 and 2006, particularly in access to 24-hour brain imaging and specialist ward rounds. The proportion of acute units providing comprehensive services has also increased from 33 to 41 per cent. However, the availability of these features remains far from universal. Overall, only 10 per cent of patients are admitted directly into acute stroke units (data not shown).

Facilities for acute stroke care, England, Wales and Northern Ireland, 2004 and 2006

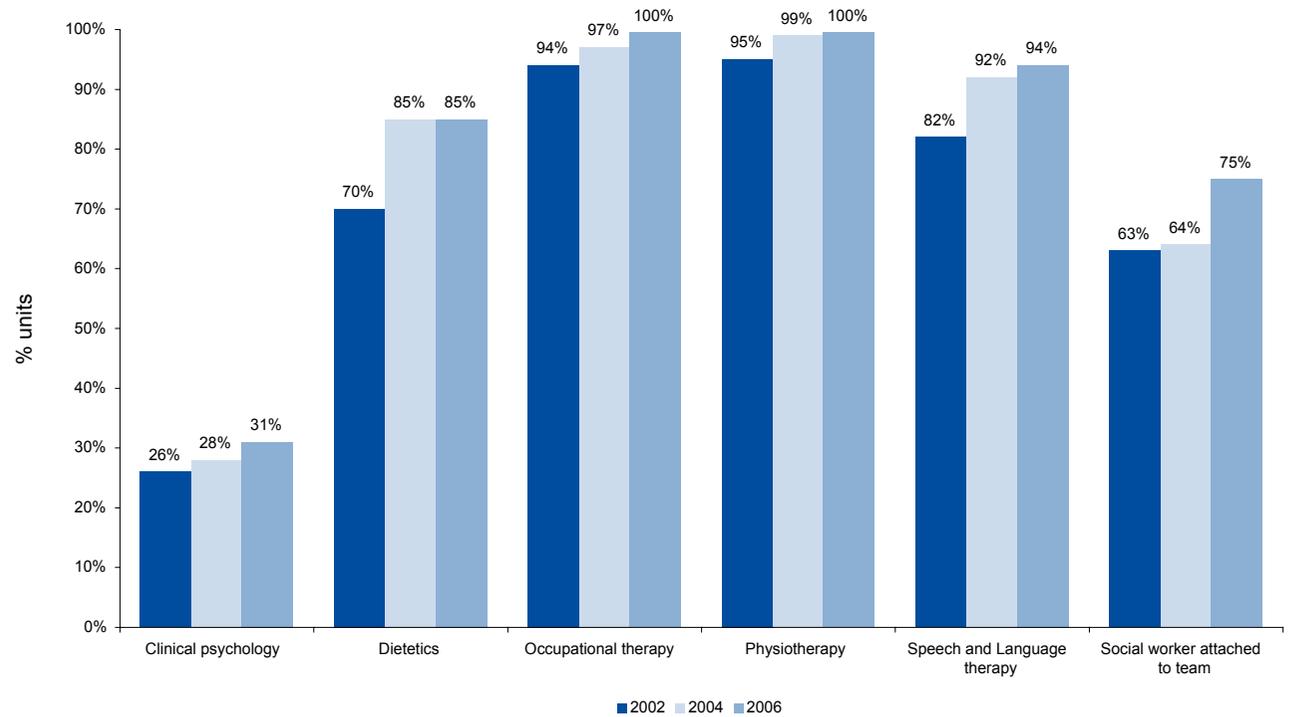


Source: Royal College of Physicians

Multidisciplinary teams

There is good evidence to suggest that care delivered by multidisciplinary teams results in significantly better patient outcomes compared with alternatives such as care delivered in a general patient ward (RCP, 2004; Department of Health, 2007). This chart illustrates the increase in the percentage of stroke units with various specialties. Over the same time period, the median number of qualified nurses/care assistants on duty at 10am increased from six in 2002 to seven in 2006 (data not shown).

Membership of multidisciplinary teams in stroke units, England, 2002, 2004 and 2006

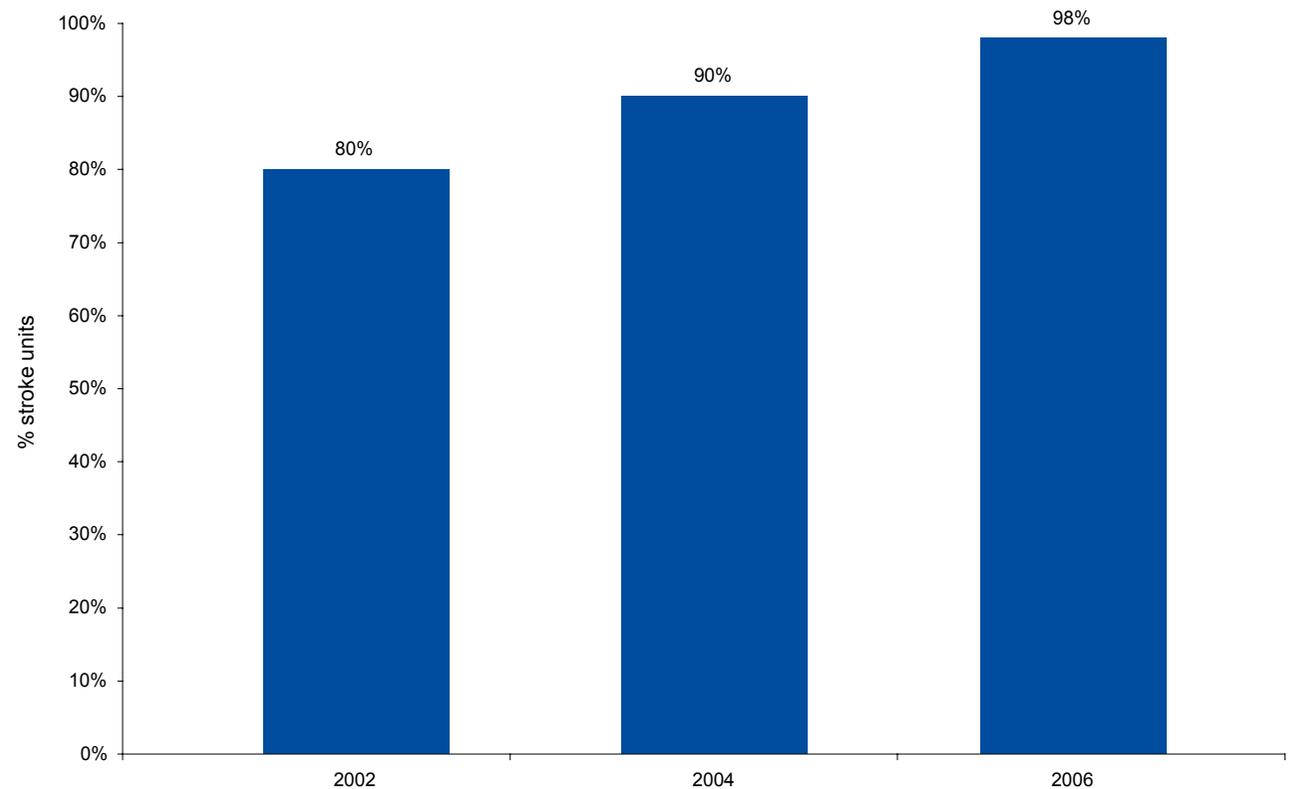


Source: Sentinel Stroke Audit, 2002, 2005, 2006

Senior medical staff

Stroke guidelines recommend that stroke services should be led by a consultant physician with specialist stroke knowledge. This chart shows the increase in the proportion of stroke units which conform to this recommendation. Additionally, the percentage of stroke units that reported zero consultant sessions per week for stroke management has decreased from 22 per cent in 2002 to just 2 per cent in 2006 (data not shown).

Consultant physician with specialist knowledge of stroke formally recognised as having principal responsibility for stroke



Source: Royal College of Physicians

Additional data from the 2006 Sentinel Stroke Audit

1. Across the country on the day of audit there were 6720 patients on site, and there were 5523 stroke unit beds, an overall ratio of 0.82 beds per stroke patient. If this ratio is calculated for each site, the site median was 0.89, up from 0.77 in 2004. In 2004 less than 50 per cent of stroke patients spent the majority of their time on a stroke unit suggesting that bed capacity was inadequate. These figures suggest that unless length of stay has fallen significantly there is still likely to be a problem of insufficient stroke unit capacity.
2. Quite large variations in the numbers of professionals employed to deliver stroke care remain between hospitals.
3. Orthotics and foot health is important for stroke patients; however, provision of these services appears scarce.
4. Most hospitals (97 per cent) now have a consultant physician responsible for stroke services. The median number of sessions has risen to five. This is better than in previous audits but still a long way from the recommendations of the British Association of Stroke Physicians, which is for two full-time equivalents (FTE) or 22 sessions per district.
5. Consultant nurse posts in stroke are still few in number and over a quarter of hospitals have no form of senior stroke nurse specialist.

Safety

Safety is a fundamental attribute of healthcare quality and has in recent years commanded significant attention internationally. It encompasses avoidance of medical error and elimination of unnecessary risk of harm to patients.

In the context of stroke, safety indicators are not well developed nor widely used in the NHS. A recent study conducted in the USA identified and analysed the range and frequency of medical errors and adverse events occurring in stroke patients (Holloway *et al*, 2007). It found that 12 per cent of stroke patients experienced an adverse event that was reported – almost half of those were deemed to be preventable. Of these preventable adverse events, 37 per cent were rooted in transcription/documentation errors, 23 per cent in failure to perform a clinical task, 10 per cent in communication/handover errors and 10 per cent in failed independent check/calculations.

In the absence of routinely available safety data specific to stroke care, researchers at the University of York undertook a bespoke analysis of routine HES data to monitor coding rates for complications following admission with a primary diagnosis of TIA or stroke.

Their findings are shown on the following page.

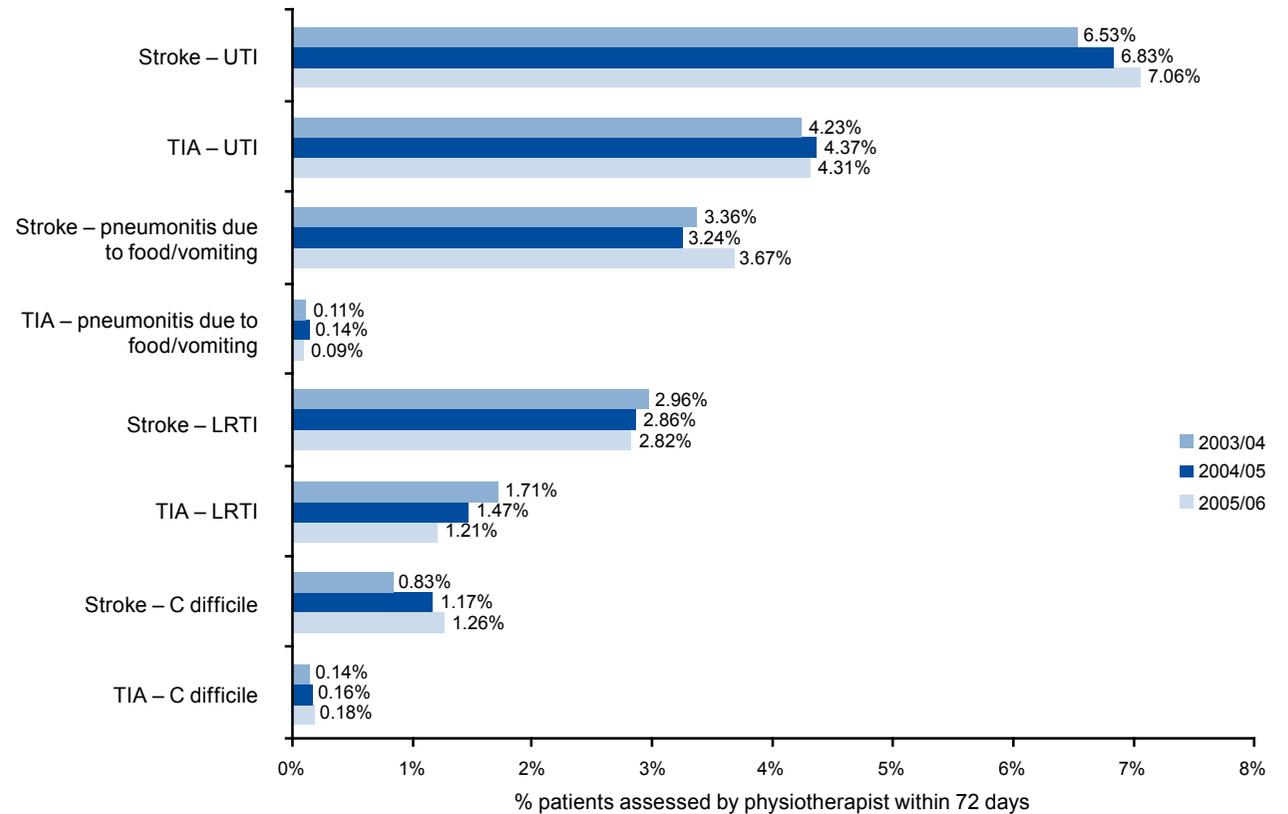
Complications of stroke can be considered as adverse events and preventable complications can be considered within the topic of safety of care. Complications of acute stroke are common and life threatening. Estimates of incidence range from 40 to 95 per cent (Davenport *et al*, 1996; Johnston *et al*, 1998; Langhorne *et al*, 2000; Bae, 2005; Smith, 2008). Most frequently reported complications include falls; urinary tract infection, pneumonia, pressure sores, depression, deep vein thrombosis and pulmonary embolism. While it is not possible to eliminate all complications of acute stroke, providing high quality care can minimise their incidence.

Positioning of stroke patients and provision of appropriate seating may prevent the development of contractures, pain, skin breakdown and respiratory complications. Staff should position patients, whether lying or sitting, to minimise the risk of complications such as aspiration, respiratory complications, shoulder pain, contractures, and pressure sores.

Complications in Acute Stroke

A team of economists at the University of York undertook an analysis of routine HES data to monitor coding rates for complications in patients admitted with TIA or stroke. The chart illustrates the percentage of continuous inpatient spells (CIPS) with a primary diagnosis of stroke or TIA, in patients over 69 years of age, that had secondary diagnoses of urinary tract infection (UTI); pneumonitis due to food or vomiting (a consequence of swallowing problems); unspecified acute lower respiratory tract infection (LRTI); and enterocolitis due to *Clostridium difficile*. With the exception of unspecified lower respiratory tract infections, there has been an increase in complication rates over the period shown. The data should be interpreted with care as coding may not be standardised over time and across NHS Trusts.

Complications after emergency admission for stroke and TIA in patients >69 years, England, 2003/04-2005/06



Source: Laudicella and Street, University of York

Patient-centredness

Quality in healthcare requires the use of best available scientific evidence, diagnostic acumen and technical proficiency which are all applied in safe and organisationally efficient environments. Alongside such tangible factors, an equally important component in quality is patient-centredness, that is, a concern for – and responsiveness to – patient preferences, attitudes and experiences.

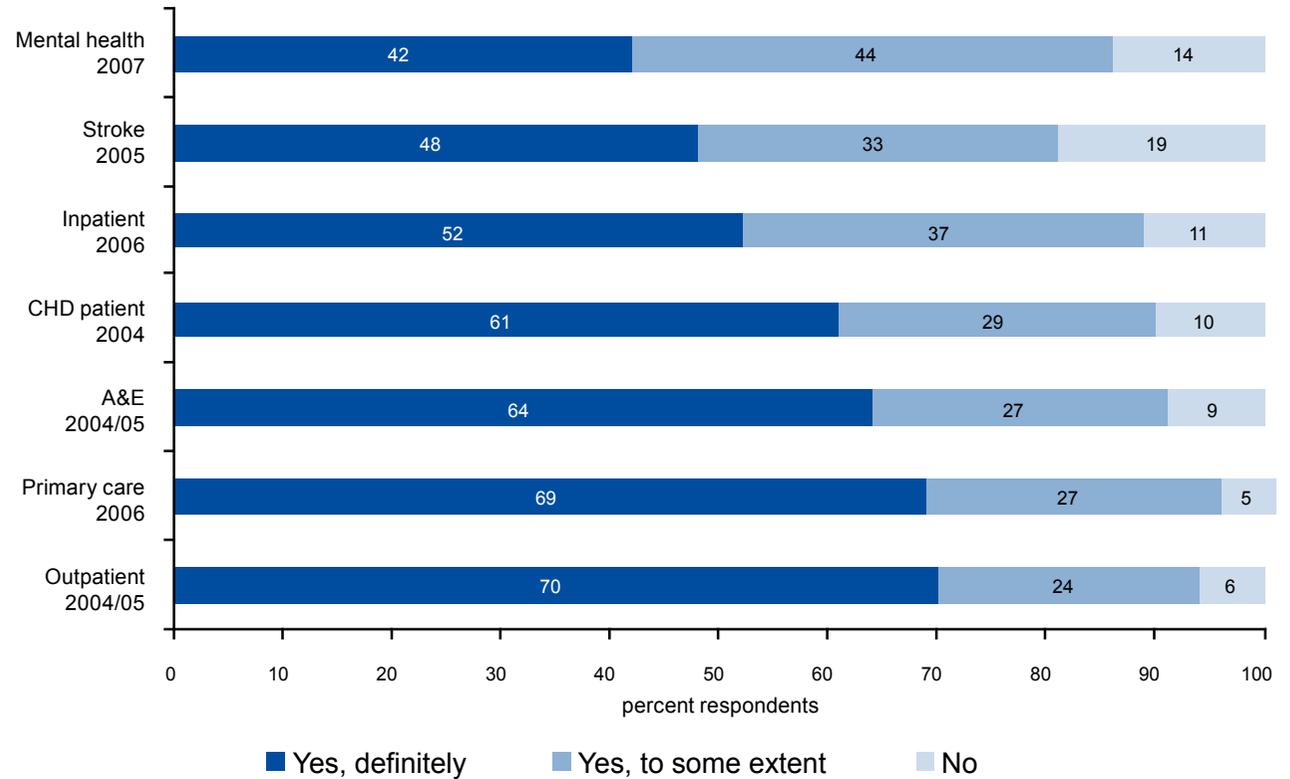
There is a growing recognition of the value of eliciting and documenting patient views as a means of evaluating quality and as a catalyst for change. This has been reflected at both a national level, with the large-scale patient surveys undertaken by the Healthcare Commission, and at a local level. The Sentinel Stroke Audit found in 2006 that 179 of the 203 hospitals (88 per cent) in England sought patients' and carers' views on their stroke services.

In recent years health policy has espoused the goal of developing a more patient-centred NHS. Research suggests that achieving this goal is some way off. In stroke care, in particular, patient surveys indicate that there is much work yet to do. This section presents a series of charts that provide a picture of patient-centredness.

Patient involvement in decisions about care and treatment

The Healthcare Commission conducts large patient surveys in England across different patient groups in the NHS. The surveys regularly ask ‘were you involved as much as you wanted to be in decisions about your care and treatment?’. Data in this chart were drawn from seven separate surveys: mental health patients, stroke patients, inpatients, patients with coronary heart disease (CHD), patients attending accident and emergency (A&E), primary care patients and outpatients. Stroke patients had the highest level of dissatisfaction with almost one in five respondents indicating they were not as involved in decisions as they would have liked to be.

Patients involved as much as they wanted to be in decisions about care and treatment, England, 2004, 2005, 2006 and 2007

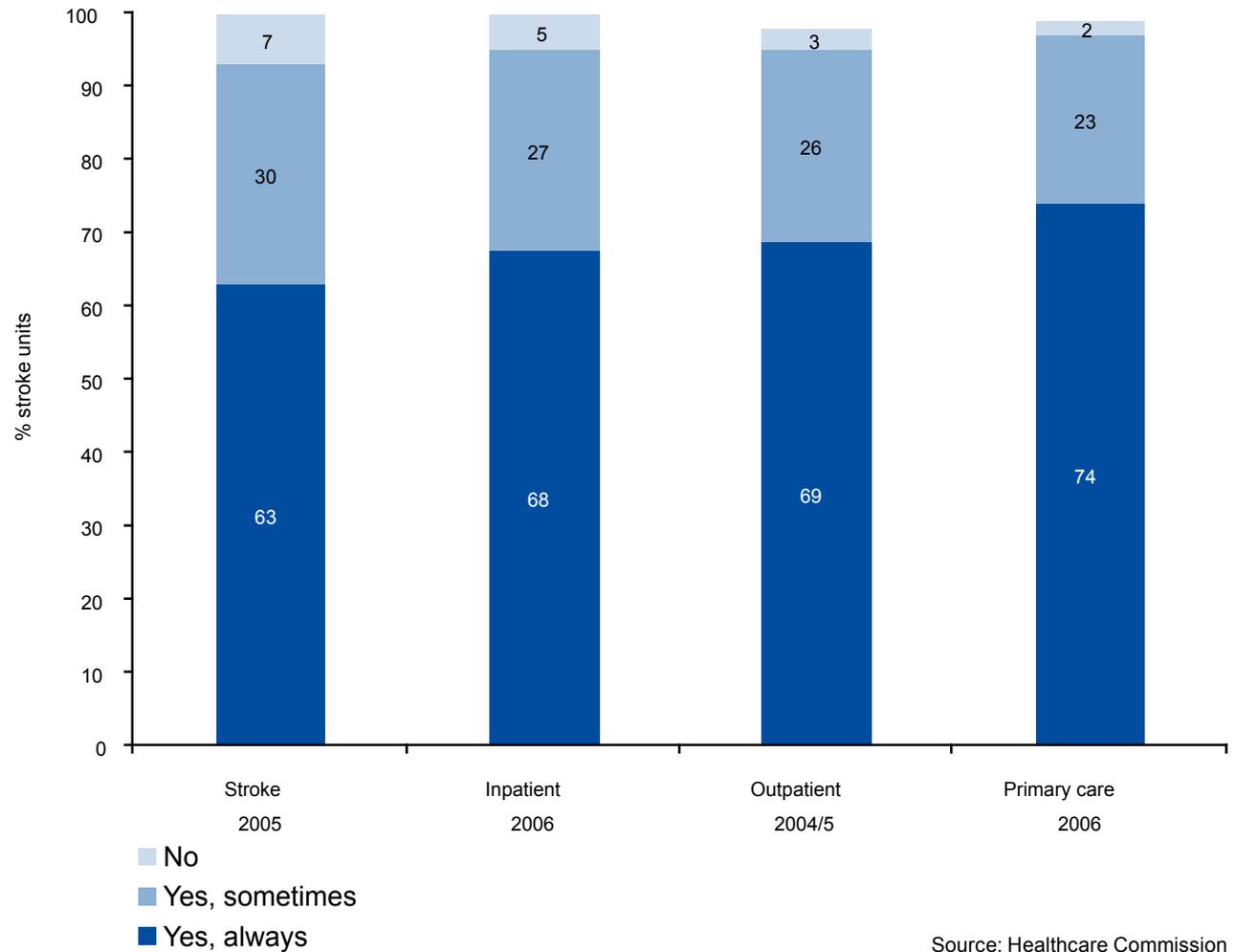


Source: Healthcare Commission

Communication

This chart draws on data from four Healthcare Commission patient surveys conducted in 2004-06: stroke patients, inpatients, outpatients and primary care patients. It depicts responses to the question ‘if you had questions to ask the doctor, did you get answers that you could understand?’. The majority of respondents indicated that they always received comprehensible answers to their questions. Comparisons across the patient subgroups revealed that stroke patients were least likely to get clear answers to their questions.

Getting clear answers to patient questions, England, 2004, 2005 and 2006

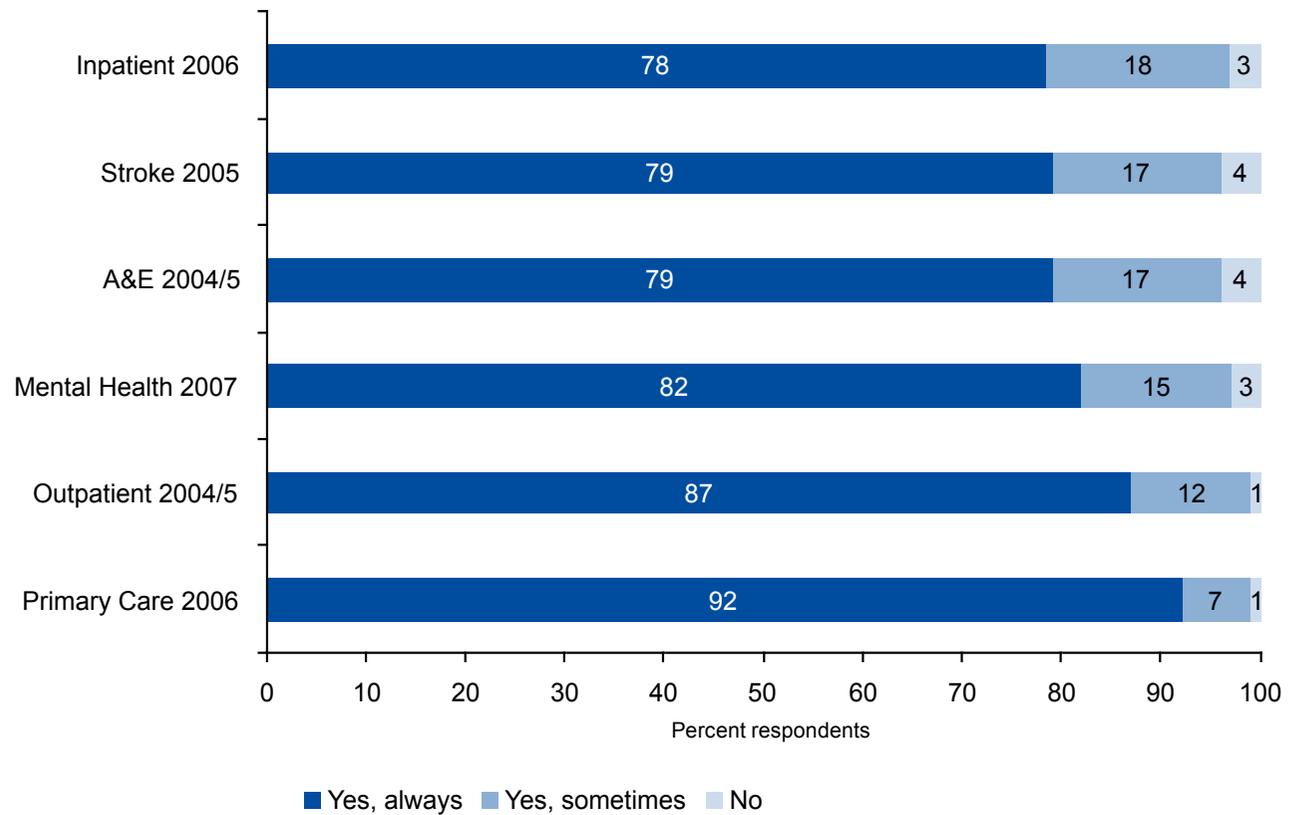


Source: Healthcare Commission

Treated with respect and dignity

The Healthcare Commission surveys asked stroke patients, inpatients, patients attending A&E, outpatients, primary care patients and mental health patients the question, 'overall, did you feel you were treated with respect and dignity?'. A large majority of respondents indicated that they were treated with respect and dignity at all times. However, it is a concern that one-fifth of stroke patient respondents felt that they were not treated with dignity and respect at all times.

Patient perceptions: treated with respect and dignity, England, 2004, 2005, 2006 and 2007

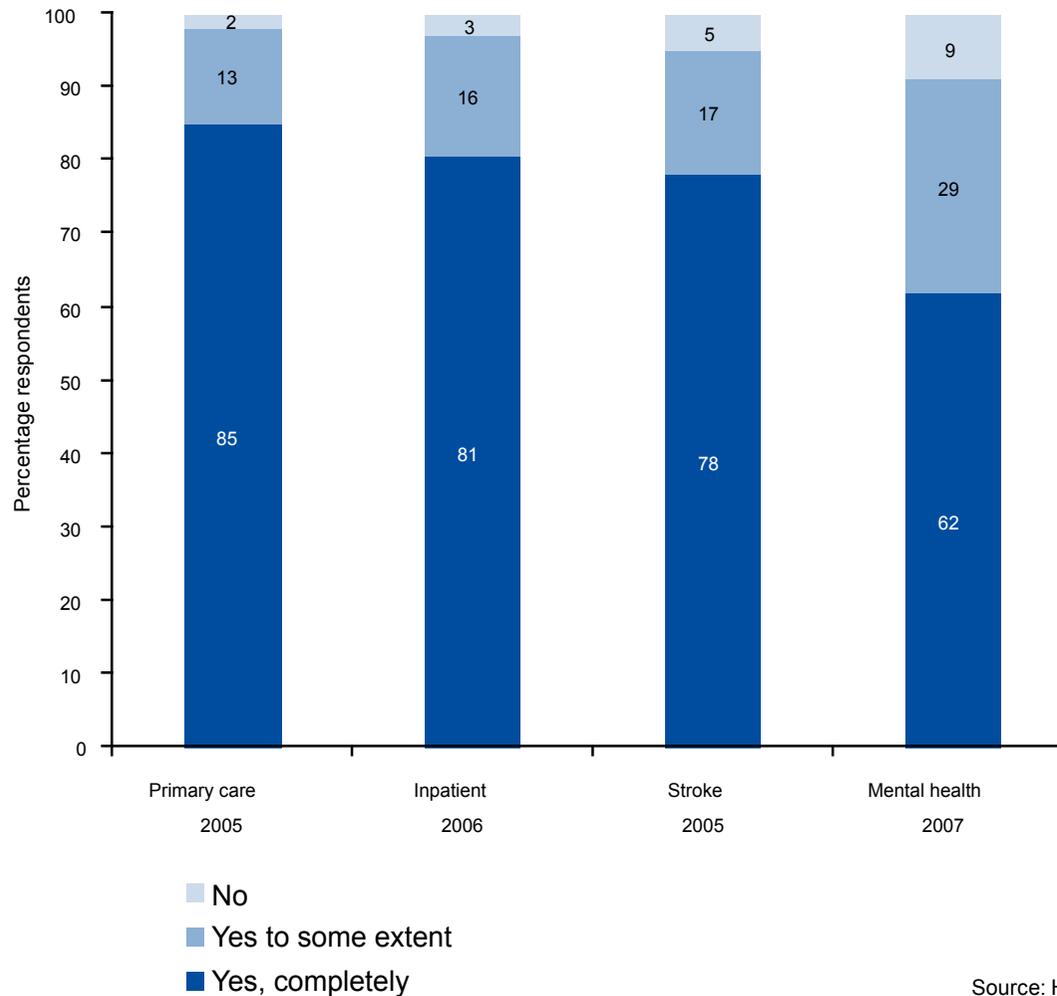


Source: Healthcare Commission

Confidence and trust

The Healthcare Commission surveys generally include the question, ‘did you have confidence and trust in the doctors treating you?’. This chart illustrates responses to four surveys published between 2005 and 2007. Over three-quarters of stroke patients surveyed indicated that they had complete confidence and trust in their doctor.

Patient feelings of confidence and trust in doctors, England, 2005, 2006 and 2007

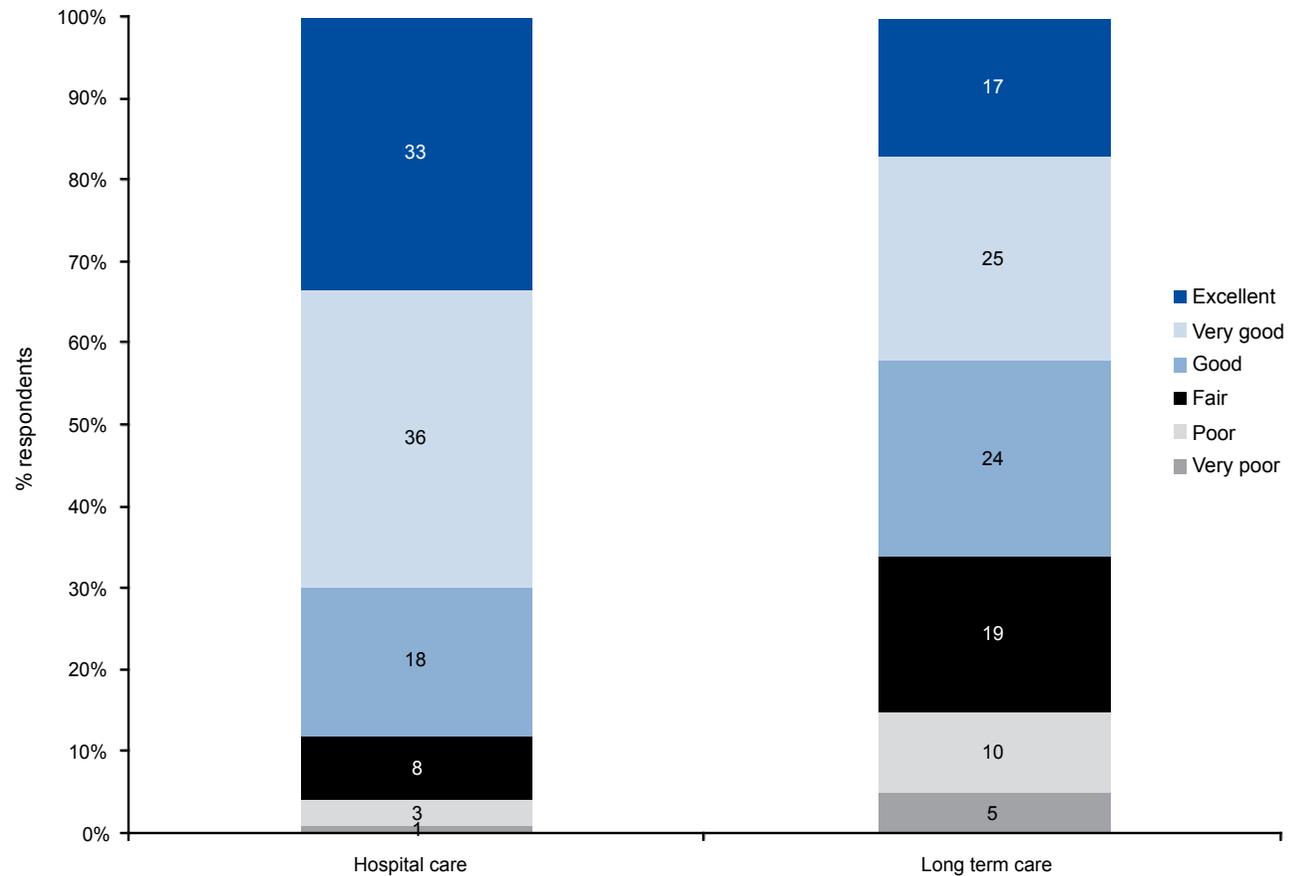


Source: Healthcare Commission

Stroke: overall assessment of care

The Healthcare Commission published two separate surveys of the same cohort of stroke patients in 2005 and 2006. Both surveys asked ‘how would you rate the care you have received for your stroke?’. The chart shows the responses pertaining to hospital care (2005) and long-term care (2006). There was a marked increase in the levels of dissatisfaction in the follow-up survey.

Overall ratings of care, stroke patients, England, 2005 and 2006



Source: Healthcare Commission

Equity

Equity, a cherished principle that underpins the NHS, refers to the principle that patients should receive the healthcare they need regardless of their background or ability to pay.

This section provides data on the extent to which care is equitable, examining whether there is evidence of differences in care provided on the basis of old age and ethnicity.

One notable gap in the data presented concerns stroke in younger people. Although stroke is predominantly a disease of people aged over 65 years, 25 per cent of strokes occur in younger people. Stroke patients under the age of 65 may not fit easily into standard services. Their medical needs often differ, with more emphasis on diagnosing the specific cause of the stroke. Rehabilitation may require specific and specialised attention to work prospects and bringing up young children. There are a number of qualitative studies that document the frustration and dissatisfaction of younger stroke patients (Kelson *et al*, 1998; Kersten *et al*, 2002; Roding *et al*, 2003) but no large data sets to quantify this issue.

A related concept, inequality in healthcare, refers to differences in health status or health outcomes across different groups or subpopulations. These variations are often attributed to differences in levels of socioeconomic deprivation.

For stroke, inequalities in outcomes have been attributed to a number of factors:

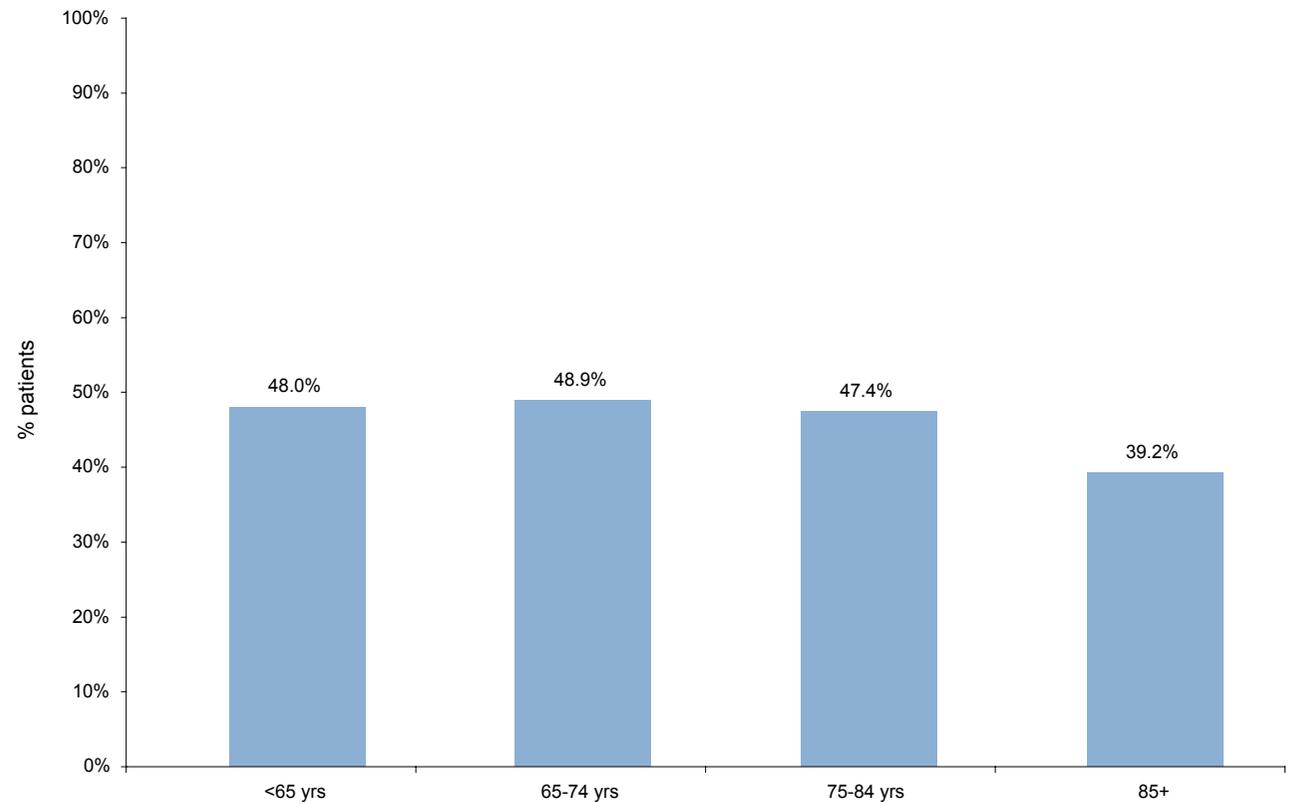
- people who are economically disadvantaged have a higher rate of stroke as well as heart disease and other related diseases
- people of African or Caribbean ethnicity are at higher risk of having a stroke – incidence rates, adjusted for age and sex, are twice as high in black people compared with white people
- more women who have strokes die from them compared with men – however, by the age of 75 stroke is more common in men compared with women.

The NAO (2005) found no evidence to suggest that patients from rural or from deprived areas were treated differently by their GPs or that these factors have an effect on whether patients achieved thresholds on preventive measures.

Admission to stroke unit by age

The *National Service Framework for Older People* (Department of Health, 2001) set the elimination of discrimination on the basis of age as one of its main targets. This chart, based on analysis of Sentinel Stroke Audit data, illustrates that ageism does exist in stroke care, indicating that older patients are less likely than younger people to be treated in a stroke unit. Further analysis found that older patients were also less likely to receive a brain scan within 24 hours of stroke: 71 per cent of patients under 65 years of age had early brain scans compared to 51 per cent of those aged 85 years or more (data not shown).

Patients treated in a stroke unit, by age, England, Wales and Northern Ireland, 2004

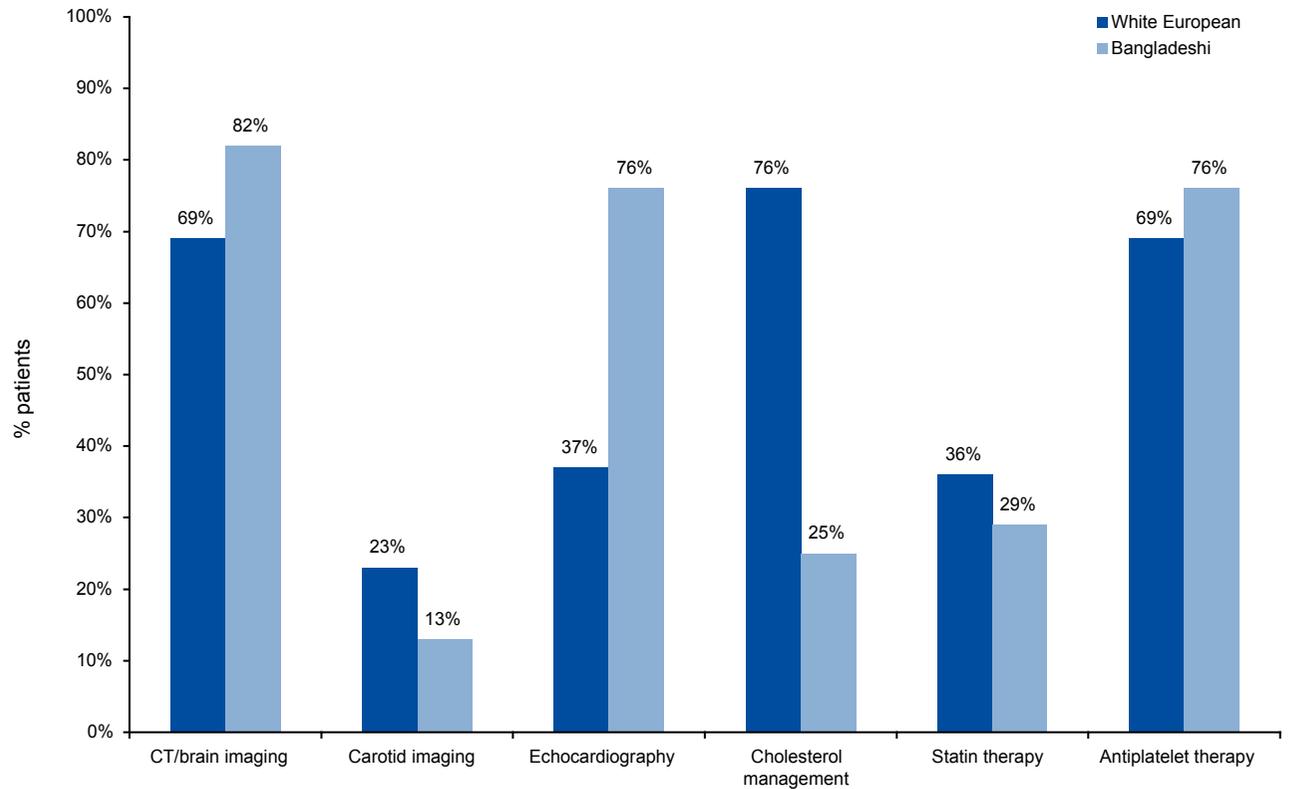


Rudd *et al*, 2007

Ethnic variations in management of acute stroke: case study

A study conducted in a London teaching hospital investigated whether there were differences in acute stroke management between white European populations and Bangladeshi populations. All surviving patients discharged over a five-year period (1997-2002) were recruited. The chart illustrates the variation in care provided to the two populations. Statistically significant differences were reported in brain imaging ($p < 0.05$), echocardiography and cholesterol measurement ($p < 0.0001$). While previous charts have illustrated recent improvement for many of these indicators, this data highlights significant disparities in care. The extent to which these have been mitigated by recent improvements is unknown.

Patients treated in a stroke unit, by age, England, Wales and Northern Ireland, 2004



Source: Bourke *et al*, 2006

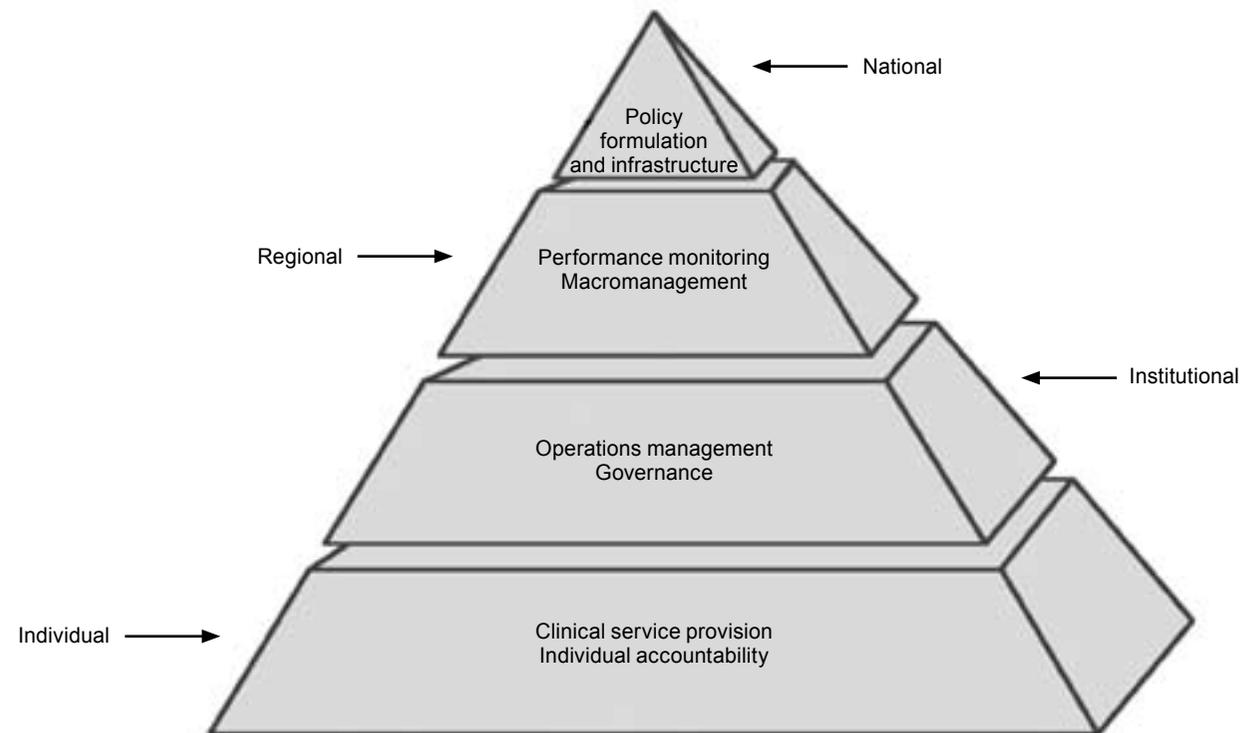
Section 3: Bridging the quality gap

Chapter 4: Evidence on improving care

Systemic improvement in healthcare

Capacity building for predictable systemic improvements in quality requires a multilevel approach involving a coherent overarching view, national direction and system building, and implementation with appropriate customisation at all levels of the healthcare system. The four levels where activity needs to occur, applicable in almost any country, are:

- national: minimal requirements are policy formulation, resourcing, infrastructure and, increasingly, accountability to the public
- regional: at a sub-national level there are usually functions of macro-management, monitoring and rationalising national policy to the particular characteristics of a region
- institutional: predictable quality improvement needs good governance and competent operations management within health (and sometimes social care) organisations – hospitals, clinics, provider networks and so on
- service or clinical level: this is where the healthcare system and an individual patient meet.



Source: Leatherman and Sutherland, 2007

Systemic improvement in stroke

Moving beyond the generic into specific disease areas, it is useful to populate the pyramid below with approaches, initiatives and interventions that are being implemented across the healthcare system. This chart provides a depiction, albeit incomplete, of current activity in stroke.



Evidence reviews

A series of comprehensive literature reviews conducted by the Research Triangle Institute (RTI) have identified available evidence on what works to improve stroke care. The reviews adopted a 'best evidence' approach focusing primarily on evidence from review articles and guidelines issued from national professional organisations. The findings are presented in four main categories:

- preventive care
- emergency care
- acute care
- post-acute care.

Interventions to improve preventive care: general population

Areas of focus	Summary of evidence
Screening and assessment of risk for CVD	<ul style="list-style-type: none"> • Evidence is strong that screening for CVD by GPs is an effective way to identify unknown cases of patients with CVD. • Primary care practices are able to implement sustainable office systems to provide preventive care services when using multi-method approaches; these include using triggers or reminder tools and having a dedicated staff member to co-ordinate prevention activities. • Some evidence suggests that in GP practices where multi-method systems are not available simple tools, such as family history, acute events or a checklist, can be effective reminders that promote CVD screening. • There is some evidence that questions the accuracy of CVD risk assessment for individuals at high or low risk. • Evidence is mixed regarding the usefulness of a CVD risk score to improve patient outcomes. • Training and education of physicians and nurses in the general practice office who are involved in identifying, monitoring and providing risk reduction interventions related to CVD can promote the use of prevention practices.
Health promotion efforts to decrease CVD risk	<ul style="list-style-type: none"> • Good evidence supports health promotion interventions by non-physicians in the primary care setting. • Good evidence supports the use of provider reminder systems in conjunction with provider education about counselling patients to quit smoking. • Some evidence suggests that physician ‘prescriptions’ for exercise increases physical activity among sedentary adults. • Some evidence supports the use of multifaceted interventions to prevent overweight and obesity among adults in workplace settings. • Evidence is mixed about the effectiveness of smoking cessation programmes in the workplace: <ol style="list-style-type: none"> a. some evidence supports use of tobacco bans to reduce cigarette smoking at the workplace during the day, however, the evidence does not support the workplace ban effect on total smoking rates b. some evidence supports the use of individual counselling and nicotine replacement therapy to help smoking cessation c. no evidence supports the effectiveness of multifaceted programmes that target smoking when used in conjunction with other CVD prevention. • Some evidence suggests that health information campaigns, including those using community organisations, can supplement the health knowledge that individuals acquire from other outlets. • Some evidence supports the use of a variety of physical activity interventions, in mixed settings, to increase physical activity and measured cardio-respiratory fitness. • Some evidence supports the positive effect of policy and environmental interventions that promote access to healthy food and access to information related to health behaviours.

Source: Bernard *et al*, forthcoming

Interventions to improve preventive care: at risk individuals

<p>Early interventions to reduce CVD risk among high risk individuals</p>	<ul style="list-style-type: none"> • There is some evidence to suggest that patient decision aids can help in the decision to initiate antihypertensive therapy but does not have long-term effects on blood pressure or CVD risk. • While there is limited evidence of successful interventions to increase adherence to medication regimens to treat hyperlipidemia, there is not sufficient evidence to recommend a specific intervention to increase patient use of lipid lowering drugs. • There is evidence to support the use of single and multifaceted interventions to target primary and secondary CVD prevention. • There is no good evidence to demonstrate that dietician advice produces better outcomes than self-help resources or nurses for cholesterol management among individuals with hyperlipidemia. • There is little evidence to support the effectiveness of physician advice on the participation in physical activity by individuals with high risk for CVD. • While there are multiple strategies used to improve identification and control of hypertension, there is no good evidence for a specific strategy to use across settings due to the mixed quality of available evidence. • There is strong evidence to support the role of local pharmacy-based interventions in improving cholesterol management among patients at high risk for CVD. • There is good evidence to support the role of community pharmacy services for promoting smoking cessation. • Home blood pressure measurement by the patient is an effective and accurate means to monitoring and controlling blood pressure.
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Source: Bernard *et al*, forthcoming

Interventions to improve emergency care

A critical step to improving stroke care is educating the public and healthcare professionals that stroke must be treated as a healthcare emergency, requiring rapid identification and intervention to transport the patient to a skilled healthcare facility.

The literature review revealed that the following interventions can improve emergency care:

- community education to increase stroke symptom recognition and decrease time to intervention for stroke patients
- use of emergency transportation to reduce the amount of time between stroke onset and initiation of treatment
- use of education programmes for emergency medical services dispatchers and paramedics to increase recognition of stroke symptoms and decrease time to initiation of treatment
- establishing standard operating procedures in the emergency department including a care pathway plan for assessing and implementing emergency stroke care to decrease the time between patient arrival and start of treatment
- use of telemedicine to provide an effective alternative model of acute stroke care in rural areas with limited access to neurologists or radiologists.

Source: Bernard *et al*, 2007

Interventions to improve acute care

Acute care for stroke patients focuses on interventions for life-threatening symptoms, supporting basic functions while the stroke is resolving (for example, breathing or nutrition) and initiating therapeutic activities that support rehabilitation. Because a stroke can affect physiologic function, physical function, cognition and communication, patients require assessment and intervention from a variety of clinical specialties including physicians, nurses and therapists. Evidence reviewed for delivering acute care to stroke patients focused on type of facility and personnel.

The literature review revealed that the following interventions can improve delivery of acute care:

- a stroke care delivery model that includes co-ordinated stroke care provided by multidisciplinary care teams – evidence shows that this model results in significantly better patient outcomes compared with alternatives such as care delivered in a general patient ward
- home care with supportive services for some older stroke patients.

Notably, the literature review revealed that there is insufficient evidence to support the use of in-hospital care pathways for the treatment of acute stroke.

Source: Bernard *et al*, 2007

Interventions to improve post-acute care

The post-acute period can last more than several months with family and caregivers providing a great deal of support for a stroke patient. The goals of post-acute care are two-fold: first to prevent additional strokes from occurring and, second, rehabilitation to enable the patient to reach his or her optimal physical, cognitive and social functional level. A large proportion of stroke patients experience an impairment of some kind following stroke. Those with severe stroke may not recover as fully as those less severely affected; however, rehabilitation can still be of significant value. There are a number of settings in which a patient can receive rehabilitative services including an in-patient rehabilitation unit and in the community. Below is a summary of interventions that have been shown to work in the delivery of post-acute care for stroke patients.

Successful interventions for delivering post-acute care for stroke patients

- Selective use of early supported discharge as an effective alternative to longer inpatient stays
- Multidisciplinary and task-oriented community-based rehabilitation to improve functional outcomes
- Beginning stroke rehabilitation as soon as possible, regardless of the setting
- Using a stroke team model to deliver rehabilitation services – the team should be comprised of disciplines such as nursing, rehabilitation medicine, social work, occupational therapy, physiotherapy, speech and language therapy and mental health

Notably, there is evidence that the setting for rehabilitation is not as important as when the therapy is initiated, how intensive it is, how long it lasts and whether it is administered by appropriate therapists (for example, occupational, speech, physical and so on).

There is insufficient evidence to warrant specific interventions to improve the quality of life for stroke patients' caregivers.

Source: Bernard *et al*, 2007

Chapter 5: Costs and benefits of improving care

‘QQUIP approaches questions of allocative efficiency by trying to identify the opportunity costs of different policies by developing our analyses of how different policies interact with each other and compete for funds.’

(Bevan *et al*, 2006)

This chapter examines the topic of setting priorities to implement change. Even with a significant injection of money into the NHS, providing adequate resources for care remains challenging. Cost-effectiveness analysis is the main economic tool to establish value-for-money and to inform priority setting. However, money is not the only scarce resource when it comes to implementing change. Managerial attention and time are among other intangible scarce resources necessary to improve quality of care. In reality, only a limited number of changes can be implemented successfully at any one time.

This chapter analyses the scale of the expected health and cost impacts of discrete interventions in England by:

- patient outcomes
- costs and benefits
- cost and reduction in the burden of disease.

Stroke interventions and patient outcomes

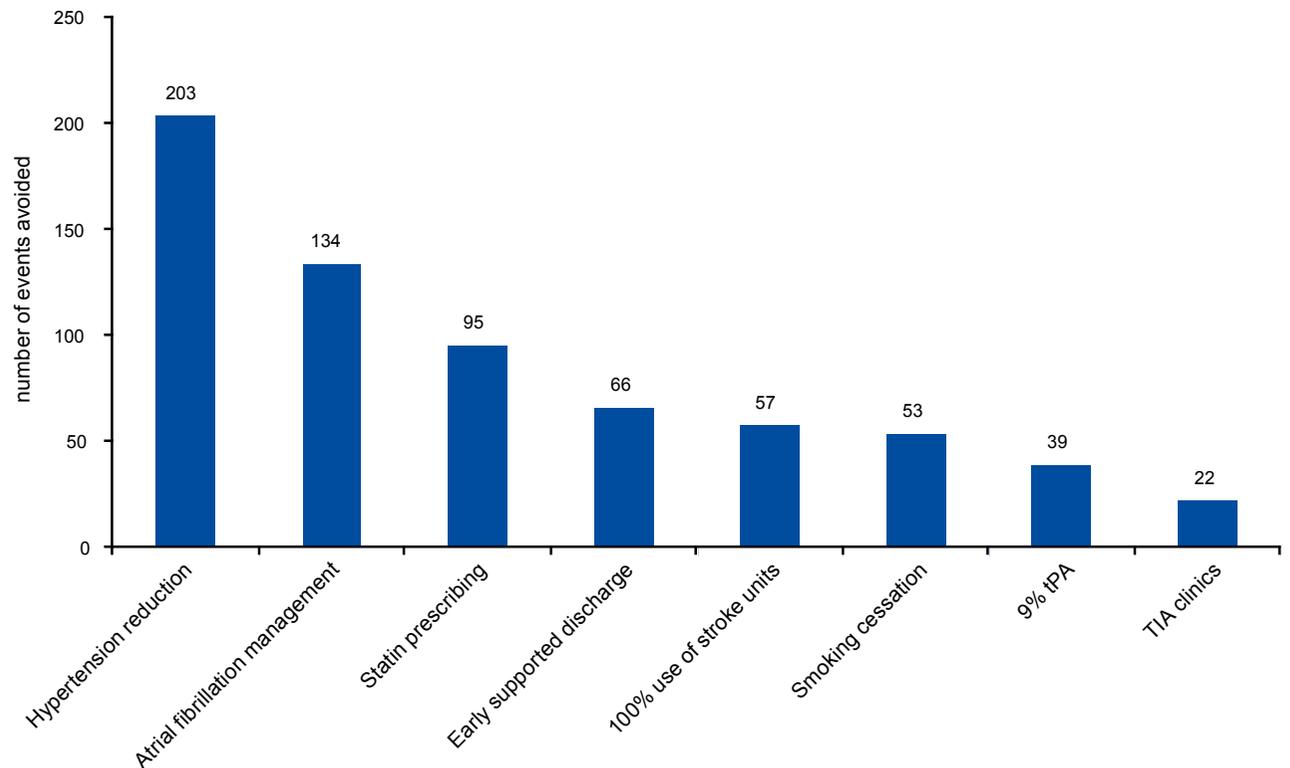
The Department of Health (2006) has developed a commissioning tool for stroke services (ASSET) at the PCT level which draws on currently available data, for example, Cochrane reviews, health technology assessments (HTAs) and major randomised control trials, and national statistics, such as hospital episode statistics (HES) and National Audit Office (NAO) data (2005). It estimates outcomes and costs of the following strategies at the local level:

- prevention with interventions that reduce hypertension
- prevention in patients with atrial fibrillation
- prevention using statins
- prevention through smoking cessation
- use of stroke unit on 100 per cent of patients
- use of thrombolysis (tPA) on 4 per cent or 9 per cent of stroke patients
- use of early supported discharge
- one-stop TIA clinics.

The chart illustrates the estimated impact of these strategies for eight PCTs in central London. Outcomes include reduction in death or disability, strokes avoided and bed-days saved.

The analysis indicates that prevention has the greatest potential to reduce the burden of disease (assuming compliance with preventative interventions).

Fatal or disabling stroke events avoided

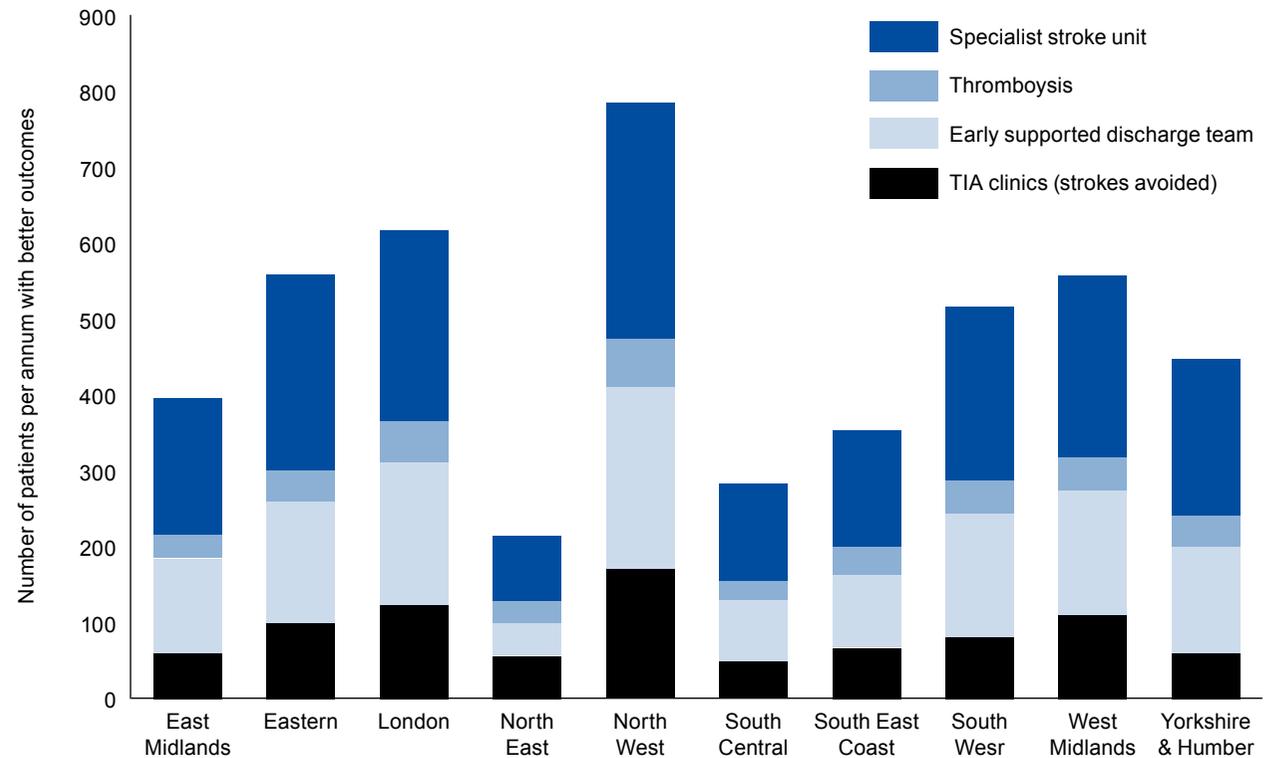


Source: Department of Health, 2006

Stroke interventions and patient outcomes by English region

The ASSET tool developed by the Department of Health is a commissioning tool for PCTs and estimates the scope for improving stroke care (2006). The National Director for Heart Disease, Professor Roger Boyle, has singled out four main recommendations and their potential to improve stroke care in England (Department of Health, 2006). This figure illustrates the modelling of potential impact of adopting these four key stroke interventions.

Numbers of patients with better outcomes per annum through adopting 4 key stroke interventions

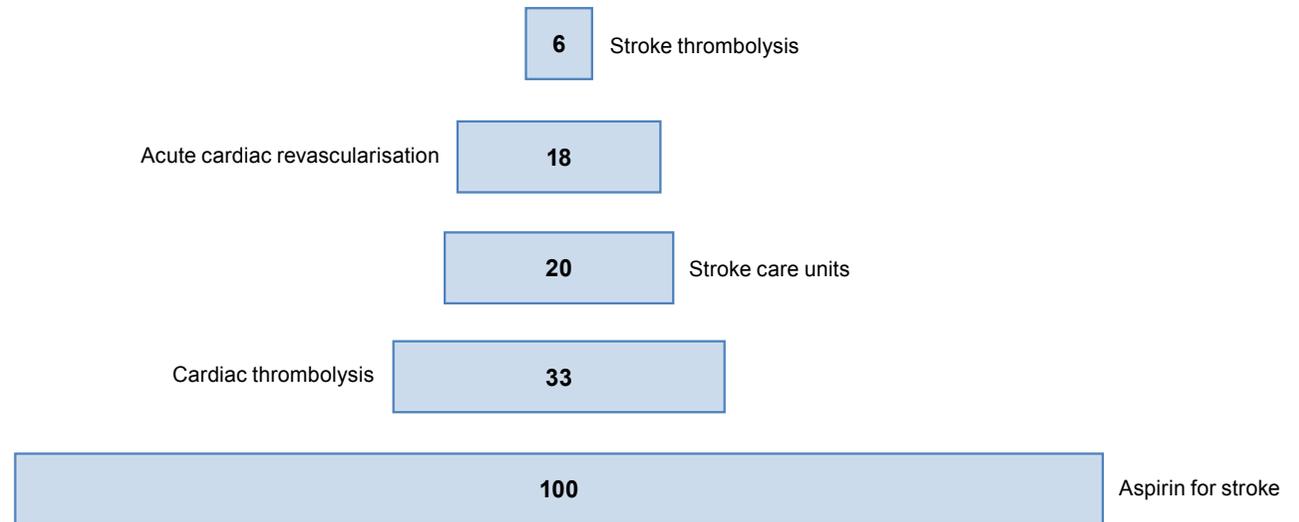


Source: Department of Health, 2006

Stroke interventions: numbers needed to treat

Thrombolysis (clot-busting treatment), if administered within three hours of an ischaemic stroke, can clear the blockage that is disrupting blood flow to the brain, reversing most or all of the damage. Thrombolysis reduces death or dependency by 140 per 1000 stroke patients (NAO, 2006). The potential impact of thrombolysis is illustrated by a comparison of number needed to treat (NNT) data. NNT is defined as the number of patients who need to be treated to prevent one adverse outcome. The chart compares the impact of thrombolysis with other interventions for cardiovascular disease. It shows that if six patients are thrombolysed, one will benefit. In comparison, 100 patients will need to take aspirin in order to benefit one patient.

Numbers that need to be treated to benefit one patient



Source: NAO, 2007

Reducing the avoidable burden of disease in stroke

A team at the London School of Economics modelled the extent to which three different interventions in stroke reduce the burden of disease as measured in a reduction in disability adjusted life years (DALYs) (Bevan *et al*, 2007). The three interventions were:

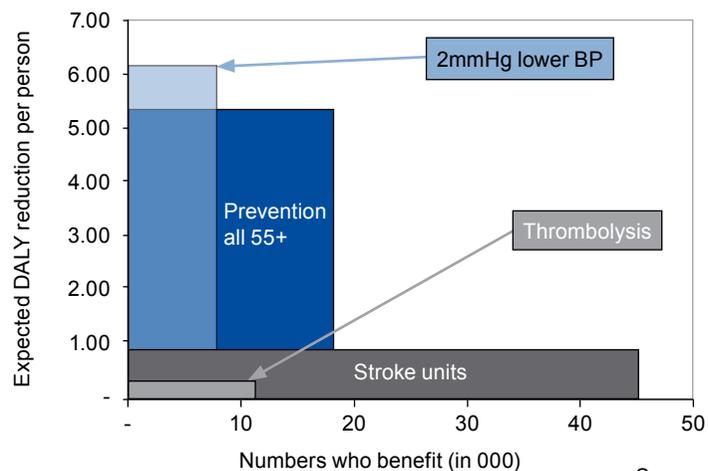
- treat 100 per cent of hospitalised patients on stroke units
- treat 9 per cent of patients with thrombolysis within three hours of stroke onset
- reduce average usual blood pressure in the population.

The chart illustrates the average per person reduction in burden of disease for, and the total numbers who would benefit from, each intervention.

Estimated impact in the short run in England			
	Avoidable burden of disease (BoD) in DALYs	Avoidable BoD as % of current BoD from stroke	Cost impact in the first year
Stroke units	47,000	5.5	Save £10m
Thrombolysis to 9%	600	0.07	£0.3m
Prescribe a first-line anti-hypertensive to all aged 55+	113,000	13	£83m
Reduce salt in processed food	54,000	6.3	Save £60m?

Comparing across the three interventions, the most people would benefit from 100 per cent care on stroke units. However, the benefit per person is relatively low. Thrombolysis has a minute impact in reducing the burden of disease at population level because a relatively small proportion of people would benefit and the treatment has no impact on mortality. Population-based, preventive interventions that reduce the average usual blood pressure in the population are those with the greatest scope for reducing the burden of disease associated with stroke (mainly by reducing deaths). Prescribing a first-line anti-hypertensive to all people over 55 would prevent about 19,000 strokes a year and substantially increase life expectancy and expected quality of life. A similar average health benefit in people who do not have a stroke as a result of the policy could be achieved by an agreement with the food industry to reduce the salt content in bread and cereals, which is estimated to prevent about 8,000 strokes a year.

Avoidable BoD from selected interventions



Source: Airoidi *et al*, forthcoming

Modelling service change

Saka *et al* (2005) estimated the immediate cost and outcome consequences of increased use of treatment guidelines for stroke. The model examined three scenarios: base, better and best case (see below left) and estimated the costs and benefits of these three scenarios (see below right). Increasing provision from the base case to the best case scenario prevented 1369 deaths and 253 recurrences, and reduced the number of very severe cases by 164, at a cost of £69 million.

Different rates of service provision in the three scenarios

		Base case	Better case	Best case
Acute care	% of eligible patients taking aspirin	0.68	0.75	0.95
	% of eligible patients going to stroke unit	0.50	0.75	0.95
	% of eligible patients being thrombolised	0.01	0.20	0.50
Secondary prevention	% of eligible patients taking antiplatelets	0.85	0.90	0.95
	% of eligible patients taking antihypertensive drugs	0.85	0.90	0.95
	cholesterol lowering drugs	0.64	0.75	0.95
	carotid endarterectomy	0.20	0.75	0.95

Cost and benefits of the three scenarios

	Base case	Better case	Best case
Cost	1,202,100,000	1,238,200,000	1,270,900,000
Total death	23,922	23,239	22,553
Total stroke recurrence	4,019	3,924	3,765
Number of independent cases after stroke	21,540	21,793	22,046
Number of very severe cases after stroke	6,986	7,068	7,150
Change in costs		36,000,100	68,900,000
Change in the number of deaths		-683	-1,369
Change in the number of recurrence		-95	-253
Change in the number of independent cases		253	507
Change in the number of very severe cases		82	164

Source: Saka *et al*, 2005

Cost-effectiveness of brain imaging and thrombolysis

Wardlaw *et al* (2004) found that immediate CT scanning of stroke patients is the most cost-effective strategy (lower overall costs and more health benefits). The table below shows comparisons – financial and quality adjusted life years (QALYs) – for 1000 patients aged 70 to 74 years.

Policy	Cost (£ 000,000)	QALYs gained
Scan all strokes within 48 hours	10.28	1982.3
Scan all strokes immediately	9.99	1982.4
Scan patients on anticoagulants and those in a life threatening condition immediately and the rest within 14 days	12.59	1931.8
Scan no patients	10.54	1904.2

Sandercock *et al* (2004) found that if eligible patients were treated with thrombolysis (t-PA) up to six hours after stroke there was a 78 per cent probability of a gain in quality adjusted survival in the first year, compared with standard care, at a cost of £13,581 per QALY gained. Over a lifetime, t-PA was associated with cost savings of £96,565 per QALY. However, the Cochrane review found that thrombolysis between three and six hours after stroke was also associated with higher mortality (Wardlaw *et al*, 2003).

Cost-effectiveness analysis for three interventions

Hankey and Warlow (1999) conducted a cost-effectiveness analysis of stroke units, aspirin and thrombolysis. The table below illustrates their findings. While the calculation of the number of deaths/dependents avoided per 1000 treated shows that thrombolysis is most effective, this intervention is not suitable for all patients. Hankey and Warlow used the estimate that only 10 per cent of patients were suitable for thrombolysis (as compared to 80 per cent of stroke patients eligible for care in a stroke unit). Overall, this means that stroke units were found to be the more cost-effective intervention.

Intervention	Number of deaths/dependents avoided per 1000 treated	Target population (% of all strokes)	Approximate cost per death or dependency avoided (\$AUS)
Stroke unit	56	80	? nil additional
Aspirin	12	80	\$83
Thrombolysis	63	10	\$36,000 (t-PA) \$3200 (streptokinase)

Source: Hankey and Warlow, 1999

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Appendix 1: Key stroke publications – summaries

National Stroke Strategy: Ten-point plan for action

1. **Awareness:** improve public and professional awareness of stroke symptoms.
2. **Preventing stroke:** support healthier lifestyles and take action to tackle vascular risk, for example hypertension, atrial fibrillation and high cholesterol.
3. **Involvement:** involve people with stroke in their care planning. Involve those who have had a stroke in planning and evaluating local services.
4. **Acting on the warnings:** TIAs are a clear warning sign that a further stroke may occur and the time window for action is very short – in about half of cases, a matter of days. Put in place a system that responds quickly (within 24 hours) to people who have had a TIA.
5. **Stroke as a medical emergency:** get people quickly to the right hospital where there are specialists who can deliver acute treatments including thrombolysis. Ensure that everyone who could benefit from urgent care is transferred to an acute stroke centre that provides 24-hour access to scans and specialist stroke care.
6. **Stroke unit quality:** stroke unit care is the single biggest factor that can improve a person's outcomes following a stroke. Successful stroke units are built around a stroke-skilled multidisciplinary team that is able to meet the needs of the individuals.
7. **Rehabilitation and community support:** intensive rehabilitation immediately after stroke, operating across the seven-day week, can limit disability and improve recovery. Specialised rehabilitation needs to continue across the transition to home or a care home, ensuring that health, social care and voluntary services together provide the long-term support people need as well as access to advocacy, care navigation, practical and peer support.
8. **Participation:** assistance to overcome physical, communication and psychological barriers to engage and participate in community activities helps people to lead more autonomous lives and move on after stroke. This will be across the range of community services – housing, education, leisure, transport, employment – that can help people to participate in community life again.
9. **Workforce:** people with stroke need to be treated by a skilled and competent workforce. Resources to assist services in planning their workforce requirements are signposted in this strategy.
10. **Service improvement:** this new vision for stroke care demands services working together in networks, looking across all aspects of the care pathway. Regular local and national audit and increased participation in clinical trials will also drive improvements in stroke care.

Source: Department of Health, 2007

NICE Guidelines for Acute Stroke

Draft consultation January 2008 – draws on guidelines by Royal College of Physicians

- In people with sudden onset of neurological symptoms a validated tool, such as FAST (Face Arm Speech Test), should be used to screen for a diagnosis of stroke or TIA.
 - People with a suspected TIA who are at high risk of stroke should receive:
 - o immediate initiation of aspirin
 - o specialist assessment within 24 hours of onset of symptoms
 - o commencement of secondary prevention as soon as the diagnosis is confirmed.
 - All people with suspected stroke should be admitted directly to a specialist acute stroke unit.
 - Brain imaging should be performed immediately (ideally the next slot and definitely within one hour, whichever is sooner) for people with acute stroke who have:
 - o indications for thrombolysis or early anticoagulation, or
 - o been taking anticoagulant treatment, or
 - o a known bleeding tendency, or
 - o a depressed level of consciousness, or
 - o unexplained progressive or fluctuating symptoms, or
 - o papilloedema, neck stiffness or fever, or
 - o severe headache at onset of onset of stroke.
- On admission, people with acute stroke should have their swallowing screened by an appropriately trained healthcare professional before being given any oral foods, fluid or medication.

National Clinical Guidelines for Stroke

The National Clinical Guidelines for Stroke were developed by the Intercollegiate Stroke Working Party, co-ordinated by the Clinical Effectiveness and Evaluation Unit (CEEU) of the Royal College of Physicians. The working party comprised more than 30 experts nominated by professional organisations and societies to give wide representation from professionals, patients and carers.

In 2004, the Royal College released the second edition of stroke guidelines. It aimed to:

- provide explicit recommendations for practising clinicians, managers, patients and carers about the management of stroke and TIA, covering the whole care pathway from the acute event to the longer-term management in the community
- provide recommendations based on best available evidence
- give consensus statements from the working party for important areas of clinical practice where evidence is lacking.

The following pages summarise the guidelines relevant to four aspects of stroke care:

1. organisation of care
2. assessment of acute stroke
3. rehabilitation
4. longer term care.

Note that the guidelines are more extensive than these excerpts – to review other areas see links below:

- National Clinical Guidelines for Stroke (2nd edition) (www.rcplondon.ac.uk/pubs/books/stroke/stroke_guidelines_2ed.pdf)
- National Clinical Guidelines for Stroke: Tables of evidence (2nd edition) (www.rcplondon.ac.uk/pubs/books/stroke/stroke_tables_2ed.pdf)

A new edition of the guidelines is due to be released in 2008

Clinical guidelines: organisation of stroke care

- Patients should be admitted under the care of a specialist team for their acute care and rehabilitation (A*).
- Stroke service should have:
 - o a geographically identified unit that is part of the inpatient service (A*)
 - o a co-ordinated multidisciplinary team that meets at least once a week (B*)
 - o staff with specialist expertise in stroke and rehabilitation (B*)
 - o educational programmes for staff, patients and carers (B*)
 - o agreed protocols for common problems (B*)
 - o access to brain and vascular imaging services (B*).
- A needs assessment exercise should be carried out so that all stroke patients in the area have access to the same standards of care (C*).
- Any patient with persistent/continuing symptoms should be rapidly referred to hospital with the expectation of admission to a stroke unit. Exceptions may include those relatively few patients for whom the diagnosis will make no difference to management (A*).
- A neurovascular clinic for the rapid assessment of TIA and minor stroke should be available (B*).
- Services for TIA should have rapid access to imaging for patients who need it (B).
- Hospitals offering thrombolysis to patients after ischaemic stroke, outside of a trial, should only do so after specialist staff training and registration with the UK Safe Implementation Thrombolysis in Stroke Monitoring Study (SITS-MOST) programme (B).
- Specialist stroke services should be available in the community as part of an integrated system of care to facilitate early supported discharge (A*).
- Specialist day hospital rehabilitation or specialist domiciliary rehabilitation can be offered to outpatients with equal effect (A).

Note: for key to evidence grading, see Appendix 2.

Clinical guidelines: assessment of acute stroke

- Brain imaging should be undertaken as soon as possible in all patients, at least within 24 hours of onset (B*).
- The diagnosis should always be reviewed by an experienced clinician with expertise in stroke (B*).
- If the underlying pathology is uncertain, or the diagnosis of stroke is in doubt after a CT scan, MRI should be considered (B).
- The patient should be assessed on admission for:
 - o their risk of aspiration using a validated 50 ml water swallow screening tool administered by an appropriately trained professional (B)
 - o their needs in relation to moving and handling, and their risk of developing pressure sores (C).
- Subarachnoid haemorrhage should be considered in any patient presenting with sudden onset, severe and unusual headache, with or without any associated alteration in consciousness (B).

Clinical guidelines: rehabilitation

- All patients should be referred to a specialist rehabilitation team as soon as possible after admission (A*).
- All members of the healthcare team should work together with the patient, carer and family using a shared philosophy and common goals (B*).
- Patients should undergo as much therapy appropriate to their needs as they are willing and able to tolerate (A*).
- The team should promote integrating the practice of skills gained in therapy into the patient's daily routine in a consistent manner (A*).
- Patients should be screened for depression and anxiety within the first month of stroke, and their mood kept under review (D).
- All patients should be screened for the presence of cognitive impairments as soon as is practicable (D).
- Patients with aphasia should be assessed by a speech and language therapist as to their suitability for intensive speech and language therapy (B).
- A physiotherapist with expertise in neuro-disability should co-ordinate therapy to improve movement performance (C).
- All patients with difficulties in activities of daily living should be assessed by an occupational therapist with specialist knowledge in neurological rehabilitation (A).
- Every patient, at home or leaving hospital, should be assessed fully to determine whether equipment or adaptations could increase safety or independence (A).
- All patients with stroke should be routinely assessed as to whether pain is a significant problem and be referred to a specialist service if necessary (D).

Note: for key to evidence grading, see Appendix 2.

Best practice: longer term management

- Hospital services should have a protocol (A) to ensure that:
 - o patients and families are involved in plans for transfer to community (D)
 - o all necessary equipment and support services are in place (D)
 - o any continuing treatment starts without delay (A)
 - o patients are given information about local services (D).

Patients should continue to have access to specialist stroke care and rehabilitation after leaving hospital (A*).

Patients and their carers should have their individual psychosocial and support needs reviewed on a regular basis (A).

Any patient with reduced activity at six months or later after stroke should be assessed for a further period of targeted rehabilitation (A).

Independence should be encouraged. As patients become more active, consideration should be given to withdrawal of physical and psychological support, enteral tubes, cessation of therapy and withdrawal of personal care support (D).

Guidelines for prevention

Hypertension

Worldwide, approximately 50 per cent of the burden of cardiovascular disease in people aged 30 years and over can be attributed to a systolic blood pressure of 115mmHg or above, 31 per cent to high cholesterol and 14 per cent to smoking. These effects overlap to some extent so that the three risk factors combined contribute to about 65 per cent of total cardiovascular disease in this age group.

A large-scale international study has shown that significantly increased risks of cardiovascular disease begin to appear at a level as low as 115/75mmHg. This is far lower than the average adult blood pressure in England which is 131/74mmHg for men and 126/73mmHg for women. According to the World Health Organization (WHO) the global disease burden attributable to a systolic blood pressure of 115mmHg or above is:

- 20 per cent of all deaths in men and 24 per cent of all deaths in women
- 62 per cent of strokes and 49 per cent of coronary heart disease
- 11 per cent of DALYs.

NICE guidance (2006) advises on measurement, lifestyle interventions, risk assessment, drug treatment and continuing treatment. Drug therapy is recommended for patients with:

- persistent high blood pressure of 160/100 mmHg or more
- persistent blood pressure above 140/90 mmHg and raised cardiovascular risk (10-year risk of cardiovascular disease of at least 20 per cent, existing cardiovascular disease or target organ damage).

The aim is to reduce blood pressure to 140/90 mmHg or less, adding more drugs as needed, until further treatment is inappropriate or declined.

Hyperlipidaemia

Trial evidence has shown that statins reduce CVD events by around 23 per cent and total mortality by 12 per cent irrespective of baseline risk (Baigent *et al*, 2005). Statins have been shown to reduce risk of stroke by 25 per cent for patients with 20 per cent or greater 10-year risk of developing CVD (NICE, 2007). Statin therapy is therefore recommended as part of the management strategy for the primary prevention of CVD for adults who have a 20 per cent or greater 10-year risk of developing CVD. This level of CVD risk should be estimated using an appropriate risk calculator, or by clinical assessment for people for whom an appropriate risk calculator is not available (for example, older people, people with diabetes or people in high-risk ethnic groups).

Appendix 2: Grading of evidence for Royal College of Physicians stroke guidelines

Guideline strength: level of evidence and grade of recommendation

Level of evidence	Type of evidence	Grade of recommendation
Ia	Meta-analysis of randomised controlled trials (RCTs)	A
Ib	At least one RCT	A
IIa	At least one well designed, controlled study but without randomisation	B
IIb	At least one well designed, quasi-experimental study	B
III	At least one well designed, non-experimental descriptive study (for example, comparative studies, correlation studies, case studies)	B
IV	Expert committee reports, opinions and/or experience of respected authorities. This grading indicates that directly applicable clinical studies of good quality are absent.	C
Consensus of working party	Recommended good practice based on the clinical experience of the Guideline Development Group	D