Developing a National System to Monitor the Quality of Hospital-based Stroke Services

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Executive Summary

Introduction

Stroke is common, frequently results in death or long term disability and is often poorly managed. For these reasons the Scottish Executive has identified stroke as a priority. The Scottish Stroke Care Audit was established in 2000 and by 2005 included all 32 hospitals admitting patients with acute stroke in Scotland.

Aims and objectives

The Scottish Stroke Care Audit aims to:

- Drive improvements in the organisation and delivery of stroke care by encouraging sharing of good practice, adherence to best evidence, and better recording of patient care.
- Routinely monitor the performance of Scottish Hospitals to improve accuracy and clinical usefulness of routinely collected data, measure against nationally agreed standards for stroke care, such as the stroke components of the Scottish Executive's Strategy for Coronary Heart Disease (CHD) and Stroke, facilitate an ongoing programme of national time-limited audits of specific aspects of stroke care, and facilitate benchmarking and permit comparisons between units by encouraging all NHS Boards to use a common data set (with explicit definitions) collected using standard methods.
- Support management decision making by providing data to allow better service planning, providing data for consultant appraisal to reflect an individual clinician's performance, bridge the gap between the routine data collection systems currently available (mainly through the NHS National Services Scotland's Information and Statistics Division's (ISD) Scottish Morbidity Record 01 (SMR01) and the expected future Clinical IT systems.

Methods

All hospitals aim to capture a minimum dataset on all adult patients admitted with an acute stroke or who have an acute stroke whilst in hospital. In addition some hospitals include patients attending their neurovascular outpatient clinics. The minimum dataset, with explicit definitions of each item, focused on those aspects of care, which are known to influence outcome, and so were included in NHS Quality Improvement Scotland (QIS) standards. Each hospital is responsible for their local audit including data collection, data management and quality assurance.

The National Audit is a confederation of these local audits. Annual reports are produced by a co-ordinating office which combines the data from these local audits to provide a national picture and to allow external benchmarking. This process is facilitated by each hospital entering, storing, and reporting on its data using the same software, purpose built for the audit.

The audit has never aimed and was not designed to produce an accurate and reliable measure of the quality of stroke care in Scotland as a whole however in this report data pooled from participating hospitals has been presented to provide a national picture.

Results

The results of the audit for each individual hospital have been reported in full in the National Reports for 2004–2005 and 2005–2006 (www.strokeaudit.scot.nhs.uk/). These provide detailed information about the numbers of patients included within each hospital and NHS Board, their process of care, and their crude and casemix adjusted 6 month case fatality.

The audit has included 18,623 patients with an acute stroke since 2000. There are major differences between the patients identified by the local audit staff and those identified via routine diagnostic coding on ISD's SMR01. Hopefully this work will lead to improved accuracy of routine data collection in both the audit and SMR01.

The audit has demonstrated moderate-sized but statistically significant improvements in most aspects of care. For example the proportion of patients accessing stroke units within one day of admission increased from 40% to 47% over 1-2 years; the proportion having a brain scan within two days rose from 71% to 76% and the proportion of those with ischaemic strokes receiving aspirin within two days rose from 43% to 55%. These data suggest that the Scottish Executive's strategy for stroke is working, though improvements have not been achieved in all hospitals and Managed Clinical Networks have more work to do to provide the highest possible quality of care in all parts of Scotland. A time limited audit of the assessment of swallowing safety demonstrated an increase in proportion having a swallow assessment within a day of admission from 33% to 47%.

The data collected by each hospital were linked to data collected by ISD to allow the 6 month case fatality to be determined for each patient. These analyses demonstrated wide variation between NHS Boards and hospitals, but indicated that most of this variation resulted from variation in casemix, i.e. hospitals with worse outcomes admit patients who are older, frailer and have more severe strokes.

Conclusions and recommendations

The audit has fulfilled its main aims. A National Stroke audit has been established which has enabled a standard minimum dataset to be collected for the vast majority of stroke patients admitted to hospital. These data have indicated that the process of care often falls short of the standards laid down by NHS QIS. They also show that care is improving across Scotland overall though there is still wide variation between hospitals and a lot of work still needs to be done to achieve more equitable delivery of specialist stroke care across different hospitals and NHS Boards.

We recommend that the National Audit continue to monitor the performance of hospitals in Scotland. The audit allows the NHS boards to monitor their performance against NHS QIS standards and ensure progress against targets set in the National Strategy.

Actions

Funding of the National Audit is to continue, and from 1 August 2006 will be provided by the Scottish Executive. An IT and audit subgroup of the National Advisory Committee for Stroke has been established to co-ordinate several inter-related pieces of work. One important aim of this subgroup is to facilitate the audit in the future by developing clinical systems which will capture the majority of the audit data as a by product of clinical care and thus reduce the resources required for local data capture.

1 Introduction

1.1 Stroke in Scotland

Stroke is the third most common cause of death in Scotland and the most common cause of severe physical disability amongst adults. It is estimated that about 15,000 people in Scotland have a stroke each year. Hospital care for these patients accounts for 7% of all NHS beds and 5% of the entire NHS budget. Not surprisingly the Scottish Executive has identified stroke as a priority.

There is now strong evidence that the way patients with stroke are managed affects their outcome in terms of survival, functional status and risk of recurrence. Organised stroke care delivered through a stroke unit as well as specific medical interventions have been shown to improve outcome[1]. The Scottish Intercollegiate Guidelines Network (SIGN) have produced four guidelines[2,3,4,5] which take account of this evidence, much of which has been collated by members of the Cochrane Collaboration Stroke Review Group which is funded by the Chief Scientist Office (CSO) and based in Scotland.

1.2 Background to the Audit

Since 1993 the Clinical Resource and Audit Group (CRAG – which became part of NHS Quality Improvement Scotland, NHS QIS, in January 2003) and subsequently NHS QIS have been publishing outcome indicators for stroke based on routinely collected hospital discharge data[6]. The value of these as indicators of the quality of services is generally considered questionable because of concerns regarding the accuracy of diagnostic codes and the lack of data to take full account of casemix. Acknowledging these difficulties, the Scottish Executive and the Chief Scientist Office (CSO) funded the Scottish Stroke Outcomes Study Group. This group has shown that it is feasible to measure the quality of hospital-based stroke services by collecting data to allow more robust correction for variations in casemix and indicators of the process of care[7,8,9].

In 1998 the Scottish Stroke Collaboration was established under the auspices of the Royal Colleges of Physicians in Edinburgh and the Physicians and Surgeons in Glasgow. This collaboration comprised all the physicians with responsibility for running hospital-based stroke services in Scotland. Two of its principal aims were to set standards for stroke care and to develop a system by which these could be routinely monitored. This led to the development of the Intercollegiate Stroke Standards Group, which has already agreed some explicit standards for certain aspects of care. In addition, with funding from Chest Heart and Stroke Scotland (CHSS) and the Royal College of Physicians of Edinburgh (RCPE), the collaboration developed the Scottish Stroke Care Audit System (SSCAS), a computer program that was designed to facilitate stroke audit.

In 2002, CRAG agreed to fund SSCAS for three years to expand the audit to a minimum of ten Scottish hospitals. This funding began in November 2002 and was continued by NHS QIS. A subsequent time-only extension was granted, bringing the total audit period to 3 years 8 months (November 2002 - July 2006).

1.3 Scottish Executive Health Department Recommendations

In October 2002 the Scottish Executive Health Department (SEHD) published their Coronary Heart Disease and Stroke Strategy for Scotland[10] which included a recommendation that all acute hospitals in Scotland should audit their stroke care. The Strategy recommended that all hospitals join the Scottish Stroke Care Audit and made the following specific recommendations:

- *All hospitals which routinely admit patients with acute stroke should introduce systems to facilitate the collection of a nationally-defined minimum dataset for each patient admitted, in order to allow monitoring of performance against nationally agreed standards;*
- *All hospitals that routinely admit patients with stroke should join the pilot phase of the Scottish Executive project to establish a National Monitoring System for hospital-based stroke services. Hospitals will need to identify a lead clinician for this project as well as staff to ensure complete data collection. Where an IT system already exists, resources should be identified to ensure its compatibility with nationally-agreed methods and datasets;*
- *If the pilot phase is successful, the system should be established as an ongoing National Audit. Part of this should be funded centrally and the remainder should be funded from contributions from participating NHS Boards; and*
- *Further development work should be resourced to establish the feasibility of and methods for linking the hospital-based systems with those in primary care, to allow capture of information relating to longer-term management of stroke patients and outcome. This work should be led by the stroke Managed Clinical Network (MCN) in each area.*

In accordance with these recommendations the pilot audit was rolled out to all acute hospitals in Scotland by the end of 2004.

1.4 NHS Quality Improvement Scotland – Stroke Standards

NHS QIS published the *Clinical Standards for Stroke Services: Care of the Patient in the Acute Setting* in March 2004[11], and carried out peer review visits across Scotland to assess performance against the standards during Sept 2004 – May 2005. The self-assessment questionnaire, which formed a central part of the review, contained many questions for which answers were only available if the Division/NHS Board was participating in the SSCA. The NHS QIS National Overview on Performance against the stroke standards was published in November 2005.

1.5 Participating centres and patient numbers

During this audit the structure of the NHS in Scotland changed. Trusts were dissolved, becoming divisions of NHS Boards which replaced the previous Health Boards. The introduction of Managed Clinical Networks (MCNs) with their focus on quality of care has facilitated the stroke audit, as has the more unified management structure within each area. In addition, in March 2006, towards the end of the period of the audit described in this report, Argyll & Clyde NHS Board was dissolved and

absorbed into Greater Glasgow NHS Board (to form NHS Greater Glasgow and Clyde) and Highland NHS Board.

All 15 (now 14) NHS Boards in Scotland are currently participating in the Scottish Stroke Care Audit and all acute hospitals admitting stroke patients are collecting data for the audit. The audit began its pilot phase at Aberdeen Royal Infirmary in July 2000. The last hospitals to begin participating in the audit began collecting data in June 2004. Our most recent National Report (2005/2006)[13] includes data for the period July 2000 to May 2006.

2 Aims and objectives

2.1 Original aims

The original aims of the study were to develop a national system to:

1. routinely monitor the performance of Scottish hospitals against nationally agreed standards for stroke care identified by the Scottish Stroke Standards Group and the Clinical Standards Board for Scotland (CSBS) (CSBS became part of NHS QIS in January 2003);
2. monitor progress against goals set by the strategy developed by the CHD & Stroke Reference group;
3. facilitate an ongoing programme of national time-limited audits in specific aspects of stroke care directed by the Intercollegiate Scottish Stroke Collaboration;
4. enhance the value of collecting routine outcome indicators for stroke by collecting data to allow fuller adjustment for variations in casemix;
5. improve the accuracy of routinely collected hospital discharge data; and
6. drive improvements in the organisation and delivery of stroke care and encourage sharing of good practice and adherence to best evidence.

2.2 Changes to the aims

The Scottish Executive Health Department's CHD and Stroke Strategy included funding for participation in SSCA for all NHS Boards in Scotland. The funding allocated was roughly £10,000 for each acute hospital, although that is a base figure with some NHS Boards receiving more (e.g. Dumfries and Galloway and the Borders), and others less (e.g. the Island NHS Boards). The funding was initially ring-fenced for the first two years of the strategy, and was subsequently extended for an additional two years, and covered the salary for an audit co-ordinator and money to purchase computers to run the audit software (SSCAS) in each centre. As a result of this additional funding, the £180,000 included in the original SSCA budget to support 10 centres' participation in the audit was redirected to increase participation in the audit from 10 hospitals to 32 (i.e., all hospitals admitting acute stroke patients routinely) and to undertake additional work to:

- bolster hospitals systems for quality assuring the audit data;
- develop software systems that encourage real time collection of audit data (it was hoped that if the system could generate discharge summaries and clinic letters this would encourage earlier data collection and reduce longer term reliance on audit staff).

The audit has never aimed and was not designed to produce an accurate and reliable measure of the quality of stroke care in Scotland as a whole however in this report data pooled from participating hospitals has been presented to provide a national picture.

3 Methods

3.1 Ethical requirements

The Multi-Centre Research Ethics Committee reviewed the SSCA in regard to compliance with the *Adults with Incapacity Act* and agreed that it was in compliance with the Act. Local Research Ethics Committee (LREC) approval was not required for collecting and using the minimum dataset or extra data collected during the hospital stay to reflect the performance of the stroke service. Nonetheless all participating hospitals were advised that they should notify their LRECs that they were participating in the audit.

3.2 Requirements for Data Protection

All data collected for the Audit were kept in compliance with the requirements of the Data Protection Act (1998).

3.3 Tools for the audit

3.3.1 Datasets

The audit collects a **mandatory core data set** for each episode that has led a patient to be referred to a hospital (Appendix C). These are the data that *must* be collected on an individual patient in order to be able to enter them into the database and include identifiers, simple demographic information, information about their interaction with the health service and a diagnosis.

A **minimum dataset** has been defined which has the mandatory core data at its centre and also aims to provide information to reflect the quality of the stroke service. We have defined these variables to help make data from different hospitals comparable (Appendix C). This minimum dataset provides information on:

- the patient
- the process of care and its appropriateness
- the performance of services in relation to National Standards.

This dataset includes six variables which describe casemix and allow correction of case fatality. These are:

- age
- whether patient was independent in everyday activities prior to the stroke
- whether the patient lived alone prior to the stroke
- whether on an assessment after admission to hospital they could talk and were not confused
- whether they could lift both arms off the bed
- whether they could walk without help from another person.

These variables have been validated as casemix adjusters in several datasets[6,7,8].

3.3.2 SSCAS Software

One of the key aims of the audit has been to develop a software system that supports the national audit. We have provided software (SSCAS) to bridge the gap between the routine data collection systems currently available (mainly through ISD's SMR01) and the expected future clinical IT systems, which will allow data for audit to be captured as part of routine care. Use of the SSCAS software was not mandatory but was initially adopted by all NHS Boards, although one has since moved to a custom-built system.

The current SSCAS software was developed using Visual FoxPro (version 5.0) runs on PCs. Improvements are ongoing. SSCAS has been designed to import information from Patient Administration Systems (PAS) and outcomes information from ISD/General Registrars Office (GRO). The export system is designed for aggregate monitoring and audit. SSCAS has been designed so that data items may be easily added or subtracted. The system generates data entry screens automatically. This makes SSCAS easily adaptable to local users' needs. Indeed, every centre has identified items additional to the minimum dataset which they aim to collect for local use.

The SSCAS software incorporates a reporting facility. Amongst other functions this allows generation of simple reports summarising the hospital's performance against national standards. These reports are designed to allow the user to monitor their stroke care services on an ongoing basis. The reporting system allows the user to produce performance indicators for a specified time period for the hospital as a whole, a stroke unit, or individual clinicians. Detailed analyses, beyond routine reporting, are facilitated by an export function in a standard format that can be interpreted by many widely used programmes (e.g. Excel™, SPSS™, MINITAB™, SAS™).

3.4 Staffing and Responsibilities

3.4.1 Central Staff

The central staff for the audit currently consists of a national clinical lead for the audit, a national audit co-ordinator, and an IT specialist. The clinical lead gives clinical guidance, in particular practical implementation of clinical guidelines and standards. The national co-ordinator is responsible for support of the local audit staff and compiling the National Report. Finally, the IT specialist is responsible for developing and maintaining the software and developing datasets for local needs. From March 2004 to October 2005 the audit had a quality assurance co-ordinator who was responsible for visiting participating centres and assisting them with implementing good practice for the audit.

3.4.2 Local Staff

Audit staff are employed at each centre with funding made available through the SEHD CHD and Stroke Strategy. Typically, a medium or large acute hospital will have one audit co-ordinator with support from their MCN. In practice, variation in hospitals is large and staffing varies widely. Audit co-ordinators' responsibilities include case ascertainment, data collection, completion of forms, data entry and provision of reports for both local and national use. Local centres are responsible for ensuring the quality of their data and no routine central validation of data is carried out.

3.5 Key Stages of the Audit

3.5.1 Case Ascertainment

The results of the audit are more easily interpreted, and thus much more valuable, if significant bias can be avoided for the patients included. This requires that all or at least the majority of stroke patients admitted (or assessed) at the participating hospitals are included in the audit; thus a robust system to identify eligible cases needs to be in place. The best method, or more likely, combination of methods, will vary depending on local circumstances and are described in each centre's Standard Operating Procedure (SOP) for the audit.

Each institution has decided whether it will include just those patients who are admitted to the hospital (i.e. stay overnight) or in addition those attending outpatient clinics and/or the Accident and Emergency department. Different systems of ascertainment are required for each.

In order to assess the completeness of case ascertainment, the cases identified by SSCAS were linked to routine hospital discharge data (Scottish Morbidity Record Type 01 – SMR01) collected by individual hospitals and held by the Information Services Division (ISD) of NHS National Services Scotland. An SMR01 is generated for every patient discharged from hospital inpatient care and contains a range of information relating to the hospital stay including demographic information about the patient and details of their diagnosis.

3.5.2 Data Collection

In designing SSCA we have tried to minimise the amount of data needed and also focussed on those data which are easily and reliably collected. Data can be extracted from unstructured case records, clerking proformas, integrated care pathways and structured discharge summaries.

3.5.3 Data Entry

All centres are using manual entry. A few also download demographic data from their patient administration systems (PAS).

3.5.4 Data Validation

It is important to ensure that the data are as complete and accurate as possible. Data validation occurs at several stages. Data entry forms are checked before data entry. Although most of this work can be done by administrative staff, an interested and knowledgeable clinician must be involved to answer specific clinical questions and ensure the validity of clinical data. SSCAS data entry screens incorporate range and consistency checks. SSCAS contains tools for checking the completeness of the data. Each centre is responsible for the completeness and accuracy of their data, but this does not guarantee that resources were sufficient to guarantee 100% completeness and accuracy.

3.5.5 Reporting

The data presented in each National Report and this Final Report were produced by pooling the reports produced by each participating centre. However, in addition, we have collected patient specific data centrally to facilitate the linkage with data from ISD. We received approval from ISD's Privacy Advisory Committee to use data held

by ISD. We obtained approval from all MCNs involved in SSCA for the use of the data held in their hospitals.

4 Results

The results of the audit have been reported in full in the National Reports for 2004/2005 and 2005/2006 (see the SSCA website for the full text of these reports: http://www.strokeaudit.scot.nhs.uk/downloads.htm). These provide detailed information about the numbers of patients included within each hospital and NHS Board, their process of care and their crude and casemix adjusted 6 month case fatality. Here we present data to illustrate to what extent we have met our principle aims. In this final report, for brevities sake and to avoid duplicating the data presented in the national reports we have presented pooled data to provide a Scotland wide picture of the quality of stroke care. The audit was not designed for this purpose and so there are some methodological caveats which need to be acknowledged – the most important is that the audit periods of different hospitals are not identical (Appendix D).

4.1 Numbers of patients enrolled into the audit

The audit aimed to include all patients admitted to Scottish hospitals with an acute stroke. Table 1 shows the number of patients with stroke entered into SSCAS in each NHS Board compared with the number of patients identified as having an admission with a stroke in the same time period from SMR01. The SMR01 has space for a primary (or main diagnosis) and five secondary diagnoses and figures for both are shown. The SMR01 diagnosis is coded using the International Classification of Diseases (version 10 or ICD10). The codes with the best positive predictive values for acute stroke are I61, I63 and I64. Others traditionally used to identify patients with cerebrovascular disease have low positive predictive values for a stroke diagnosis [7].

The time period for patients included in Tables 1, 2, 3, 6 and 7 is from the start of the audit in each NHS Board. The start date varies depending on the NHS Board. The start date is always the date on which the hospital began collecting data. The earliest start date is July 2000 in Grampian and the latest is June 2004 for North Glasgow and Ninewells Hospital. See Appendix D for a full list of the start and stop dates for these tables. For this reason, comparison of the actual number of inpatient stays between NHS Boards is not possible.

Tables 1, 2, 3, 6, 7 and 8 only include figures for patients with a stroke diagnosis; data on Transient Ischaemic Attacks in hospital are not included.

Table 1 The number of inpatient stays attributed to stroke in SSCAS and SMR01 by NHS Board during the audit period.

NHS Board	SSCAS	SMR01 coded as Stroke (ICD10 I61, I63, I64) Main diagnosis	Any diagnosis
Ayrshire and Arran	1450	1221	1431
Argyll and Clyde	1401	1730	2041
Borders	388	428	464
Dumfries and Galloway	780	667	768
Fife	1032	1069	1326
Forth Valley	1226	981	1201
Highland	621	746	849
Lanarkshire	2353	2314	2748
Greater Glasgow	2147	2314	2754
Grampian	2016	3310	3888
Lothian	4180	4989	5615
Tayside	1022	1646	2029
Orkney	31	26	39
Shetland	20	20	24
Western Isles	114	114	176

The difference between the number of inpatient stays recorded in SSCAS and SMR01 was greater when SSCAS data were compared with SMR01 data relating to a diagnosis of stroke in any diagnostic position. In some hospitals the numbers identified by SSCAS and SMR01 were very similar however this does not guarantee that they were the same patients. Table 2 shows a cross tabulation of the admissions identified by SSCAS and SMR01 to indicate how many admissions were identified as stroke in either or both systems.

Table 2 Stroke cases identified by SSCAS and SMR01

	SMR01	**SSCAS** No stroke diagnosis	**SSCAS** Stroke diagnosis	Total
All Hospitals	No stroke diagnosis	n/a	5764	5764
	Stroke diagnosis	7795	12859	20654
	Total	7795	18623	26418

Totals are higher than overall patients due to some patients having more than one admission to different hospitals in the time period

In summary, of the 18,623 patients with stroke included in the audit 5,764 were not coded on SMR01 as I61, I63 or I64. Ongoing work by ISD suggests that some will have had other cardiovascular disease (CVD) codes including I62, I65-I69 and G45. These describe stenoses of pre-cerebral blood vessels, sequelae of previous strokes and TIAs. Many will not have had any diagnostic code but simply had symptoms coded e.g. hemiparesis. There were also 7,795 cases on SMR01 with a diagnosis of stroke that were not included in SSCAS. This could be because the SMR01 picked up CVD which was not stroke or patients with prior stroke. Previous work has shown that around 20% of patients with an SMR01 stroke code have not actually had a stroke[7]. In some hospitals where they experienced problems with the audit some of the discrepancy is likely to be due to under ascertainment in the audit. A similar table has been produced for each hospital to allow them to sample those cases where only one system identified the case. This sort of local analysis will identify whether the discrepancies are due to:

- application of different standards of diagnosis between the audit and routine coding
- inaccurate or incomplete coding of diagnoses on SMR01
- use of other CVD codes in SMR01
- poor ascertainment in the audit.

It is hoped that this work will lead to improved accuracy of routine data collection in both the audit and SMR01 in line with the aims of the audit.

Table 3 shows the characteristics of patients included in the audit in each NHS Board. There were significant variations between NHS Boards which explain variations in case fatality (see 4.4)

Table 3 Age, pathological type of stroke and casemix variables for patients entered into SSCAS by NHS Board

NHS Board	Mean Age (year)	% indep-endent before stroke	% living alone before stroke	% able to talk & not confused	% able to lift up both arms	% able to walk	% with haem-orrhage on CT
Ayrshire & Arran	73	81	38	65	62	34	13
Argyll & Clyde	73	87	47	64	64	48	11
Borders	75	81	40	64	57	39	16
Dumfries & Galloway	74	87	39	51	38	23	12
Fife	74	83	37	43	45	33	13
Forth Valley	73	90	41	61	55	29	10
Highlands	73	81	29	63	54	28	15
Lanarkshire	72	81	37	64	64	36	12
Greater Glasgow	71	88	39	67	71	46	12
Grampian	72	94	35	67	70	44	13
Lothian	74	83	39	58	63	30	13
Tayside	75	86	39	61	66	41	12
Orkney	77	90	72	71	47	32	0
Shetland	75	100	30	56	56	41	40
Western Isles	77	69	30	53	47	30	12

4.2 Improving the process of care

The audit aimed to monitor the process of care given to patients and to encourage improvements. Table 4 shows the proportion of inpatients managed according to national standards in two time periods. The dates included in each period are not identical for each health board. The first period is generally one year's data with a start date in either late 2003 or early 2004, although this is not always the case. The three North Glasgow hospitals and Ninewells Hospital did not begin collecting data until 1 June 2004 and this affects the results from Greater Glasgow and Tayside NHS Boards. See Appendix D, for a full listing of the time periods for each hospital. We did not design the audit to sum data across Scotland – the national reports will show differences across hospitals and health boards. Data from earlier time periods were excluded because they were collected by only a small number of hospitals and could not therefore provide a national picture. No data for 2006 are available yet because not all patients have been discharged. Many patients with stroke remain in hospitals for at least six months.

There have been moderate sized but statistically significant improvements (i.e. the 95% CI do not overlap) in all aspects of care except for proportion discharged on antihypertensive drugs or anticoagulants.

Table 4 includes data relating to the following NHS QIS standards for stroke care:

- **Percentage Admitted to SU in <= 1 day** correlates to **NHS QIS Standard 1.4:** *"70% of all patients admitted to hospital with a diagnosis of stroke are admitted to the stroke unit within 24 hours of presentation at hospital, and remain in specialist stroke care until in-hospital rehabilitation is complete."* The date, but not the time of entry into a stroke unit is recorded so that it is difficult to apply a 24 hour standard.
- **% Scanned within 2 days of admission** correlates to **NHS QIS Standard 2.2:** *"80% of patients have CT/MRI imaging within 48 hours of admission, unless there is a documented contraindication."* Again the date but not the time of any scan is easily available. Therefore the proportion scanned within 48 hours is not easily determined without looking at every individual scan film on which the time is recorded. Also there are no absolute contraindications to either an MRI or CT scan.
- **% Started Aspirin within 2 days of admission** correlates to **NHS QIS Standard 2.3:** *"Aspirin treatment is initiated within 48 hours of admission for all patients in whom a haemorrhagic stroke, or other contraindication, has been excluded."* The time of first aspirin dose is often not easily extracted from notes.
- **% Swallow screen within 1 day of admission** correlates to **NHS QIS Standard 2.4:** *"All patients have an initial swallow screen test performed on the day of admission unless there is a documented contraindication."* According to the SIGN guidelines there are no contraindications to a swallow screen.

Other items relate to other evidence based treatments which are included in SIGN guidelines and for which data are available.

Table 4 The number and percentage of inpatients managed according to standards in two time periods. See Appendix D for a full listing of the time periods by hospital.

	Scotland 2003/2004	Scotland 2004/2005
Total Number of patients entered	**7594**	**8379**
Number of Stroke Patients	**6312**	**7077**
% Admitted to the SU within 1 day of admission	**40**	**47**
95% Confidence Interval	39 to 42	46 to 48
% Admitted to a Stroke Unit during admission	**63**	**70**
95% Confidence Interval	62 to 64	69 to 71
% Scanned within 2 days of admission	**71**	**76**
95% Confidence Interval	70 to 73	76 to 78
% Scanned within 7 days of admission	**87**	**90**
95% Confidence Interval	86 to 88	89 to 91
% Scanned during admission	**90**	**94**
95% Confidence Interval	89 to 90	94 to 95
% Swallow screen within 1 day of admission	**33**	**57**
95% Confidence Interval	32 to 34	56 to 58
% Swallow screen during admission	**37**	**64**
95% Confidence Interval	36 to 38	63 to 65
Number of Patients with Definite Ischaemic Event	**5804**	**6674**
% Started Aspirin within 2 days of admission	**43**	**55**
95% Confidence Interval	42 to 44	54 to 56
% Received Aspirin in hospital	**63**	**77**
95% Confidence Interval	61 to 64	76 to 78
Number of Patients with Definite Ischaemic Event - Alive at Discharge	**5013**	**5786**
% Discharged on Antiplatelet or Warfarin	**84**	**90**
95% Confidence Interval	83 to 85	89 to 91
% Discharged on Statin	**69**	**77**
95% Confidence Interval	68 to 70	76 to 78
% Discharged on antihypertensive	**61**	**56**
95% Confidence Interval	60 to 63	54 to 57
Number of Patients with Definite Ischaemic Event in Atrial Fibrillation (AF) - Alive at Discharge	**882**	**993**
% Discharged on Warfarin	**32**	**33**
95% Confidence Interval	29 to 35	30 to 36

4.3 A time limited audit

One of the aims was to extend the minimum dataset to audit one particular aspect of care. The assessment of swallow safety screening was chosen. The results in Table 4 indicate a significant improvement in performance across the audit cycle. Between the two audits, standards were developed and a training package was developed and disseminated.

4.4 Outpatient data

Table 5 shows the percentage of Outpatients managed according to national standards in two time periods. The dates included in each period are not identical for each health board. The first period is generally one year's data with a start date in either late 2003 or early 2004, although this is not always the case, Please see Appendix D for a full set of dates. In addition, some hospitals only recently started having neurovascular clinics, e.g. Raigmore in Highlands, and therefore they are only included in the second time period.

Table 5 includes data relating to the following NHS QIS standards for stroke care:

- **% seen within 7 days of receipt of referral** correlates to **NHS QIS Standard 1.8:** *"80% of new patients are seen within 7 days of receipt of referral to the neurovascular clinic"*
- **% seen within 14 days of receipt of referral** correlates to **NHS QIS Standard 1.7:** *"80% of new patients are seen within 14 days of receipt of referral to the neurovascular clinic"*.

Table 5 The number and percentage of patients managed according to standards in two time periods.

	Scotland: 2003/2004	**Scotland: 2004/2005**
Total number of patients entered	**3046**	**4061**
% Diagnosis: Stroke	31	30
% Diagnosis: TIA	30	30
% Diagnosis: Eye	4	6
% Diagnosis: Other	35	33
Number having surgery	61	64
Number of patients with definite cerebrovascular diagnosis	2005	2631
% seen within 7 days of receipt of referral	21	19
% seen within 14 days of receipt of referral	**44**	**43**

The percentage of patients seen within 7 and 14 days of referral to neurovascular clinics did not change significantly between 2003/4 and 2004/5. Also there was no definite trend in reducing waiting times for Carotid Endarterectomy (CEA). The most recent national report included data on 125 patients who had a CEA. The mean delay from event to surgery for these patients ranged from 32 to 212 days.

4.5 Linking process data with outcome

One important aim for the audit was to collect outcome data which depends on the collection of post discharge data. This was achieved by linking the audit data with SMR01 data from ISD concerning deaths within 6 months of admission. The advantage of using survival as an outcome measure is that the data are available for almost all patients and therefore they are not biased by missing data. In previous national reports from CRAG, 30 day case fatality was reported for individual hospitals but the data were not available to adequately adjust for variations in casemix. The audit captures data needed to adjust for casemix for most patients.

Tables 6 and 7 show the survival data for each NHS Board. Table 6 shows the number of patients who survived to six months in each NHS Board together with the predicted number of survivors based on the Scotland-wide average. Table 7 shows the same information adjusted for casemix (age, frailty and stroke severity of patients admitted with stroke).

The W score provides a convenient measure of the size of the absolute difference between numbers surviving (per hundred patients admitted) and the number predicted to survive. Thus a W score of -10 would indicate that 10 fewer patients in every hundred admitted would survive than would have been predicted; in other words a 10% greater case fatality. If the confidence intervals of the W score include zero, the Observed and Predicted survival rates are not significantly different.

In Table 7, variations between NHS Boards in case fatality might be attributable to chance although the confidence intervals give an indication of the precision of these estimates. Alternative explanations are that there are aspects of casemix which have not been adjusted for or that the differences in outcome reflect the effectiveness of care.

Table 6 Six month survival after stroke admission by NHS Board of treatment – not adjusted for casemix

		Number alive at 6 months		Excess number survived per 100 admissions with 95% CI		
NHS Board of Treatment	**Admissions**	**Observed**	**Predicted**	**W Score**	**Lower**	**Upper**
Ayrshire & Arran	1039	761	780	-1.9	-4.5	0.7
Argyll & Clyde	988	738	742	-0.4	-3.1	2.3
Borders	275	206	207	-0.2	-5.3	4.9
Dumfries & Galloway	644	470	484	-2.1	-5.5	1.2
Fife	765	483	575	-12.0	-15.1	-8.9
Forth Valley	883	653	663	-1.2	-4.0	1.7
Highland	423	293	318	-5.8	-10.0	-1.7
Lanarkshire	1644	1261	1235	1.6	-0.5	3.7
Greater Glasgow	1549	1245	1163	5.3	3.1	7.4
Grampian	1355	1156	1018	10.2	7.9	12.5
Lothian	3211	2347	2412	-2.0	-3.5	-0.5
Tayside	709	523	532	-1.3	-4.5	1.8
Orkney	14	8	11	-18.0	-40.6	4.7
Shetland	14	10	11	-3.7	-26.3	18.9
Western Isles	75	51	56	-7.1	-16.9	2.7

Table 7 –Six month survival after stroke admission by NHS Board of treatment – adjusted for casemix

		Number alive at 6 months		Excess number survived per 100 admissions with 95% CI		
NHS Board of Treatment	**Admissions**	**Observed**	**Predicted**	**W Score**	**Lower**	**Upper**
Ayrshire & Arran	1039	761	765	-0.4	-2.6	1.9
Argyll & Clyde	988	738	761	-2.3	-4.5	0.0
Borders	275	206	206	0.0	-4.3	4.4
Dumfries & Galloway	644	470	428	6.5	3.3	9.7
Fife	765	483	507	-3.1	-6.0	-0.3
Forth Valley	883	653	659	-0.7	-3.2	1.8
Highland	423	293	306	-3.0	-6.7	0.6
Lanarkshire	1644	1261	1237	1.5	-0.3	3.2
Greater Glasgow	1549	1245	1242	0.2	-1.5	1.9
Grampian	1355	1156	1126	2.2	0.4	4.0
Lothian	3211	2347	2370	-0.7	-2.0	0.6
Tayside	709	523	532	-1.2	-3.9	1.5
Orkney	14	8	10	-11.0	-31.7	9.7
Shetland	14	10	10	1.5	-19.0	22.1
Western Isles	75	51	49	2.3	-6.7	11.3

4.6 Linking patient characteristics and process of care with outcome

The relationship between aspects of a patient's management and their likelihood of dying within 6 months of admission to hospital is shown in Table 8. The analysis includes patients from all hospitals with complete casemix and treatment data.

A Hazard ratio of less than 1.0 indicates that having a particular characteristic (e.g. atrial fibrillation) or being treated in a particular way (e.g. entered into a stroke unit) is associated with a reduced risk of death. If the 95% confidence intervals of that hazard ratio do not overlap 1.0 then the reduction or increase in risk of death associated with that treatment is unlikely to have occurred by chance.

Having atrial fibrillation, being on warfarin at the time of the stroke and having haemorrhage on a CT scan are all inter-related (i.e. patients with AF are often treated with warfarin to prevent ischaemic stroke but may have a haemorrhagic stroke as a consequence of the warfarin therapy) and are all associated with a higher case fatality which is only partly due to the greater stroke severity.

Being managed in a stroke unit (but not being admitted within a day), being on aspirin and having a swallowing assessment within a day are all associated with reduced case fatality. This fits with the evidence that such interventions are important. However, certain treatments are more or less likely to be given depending on the patients' clinical state – thus the hazard ratios have been adjusted to take account of the age, degree of frailty and the stroke severity. For example, having aspirin within 2 days of admission was associated with a hazard ratio of 0.8 (i.e. a 20% reduction in hazard of death) and this was statistically significant with 95% confidence intervals of 0.7-0.8. However having adjusted for stroke severity this association disappears (HR = 1.0). This may be because aspirin is more often given to those with milder strokes – those with haemorrhagic stroke have a higher chance of dying (see haemorrhage on scan?) but are unlikely to receive aspirin.

These sorts of analyses are not very reliable in determining the effectiveness of specific treatments. For instance patients who are sicker may preferentially be admitted to a stroke unit earlier or have an earlier CT scan and thus may have a worse outcome even after having adjusted for casemix.

We looked at the effect of stroke unit care on survival beyond the first seven days because we believe stroke units are very unlikely to influence very early case fatality but rather can reduce the risk of complications which lead to later deaths. This is borne out by the reduced risk of death in those cared for in a stroke unit. Large randomised controlled trials have shown that aspirin and stroke unit care are associated with lower mortality – it is quite possible for Cox regression analyses to miss such effects.

Table 8 Cox regression - results for death at 6 months

	Unadjusted Hazard Ratio	95% CI		Adjusted Hazard Ratio (adjusted for case-mix variables)	95% CI	
Aspirin within 2 days of Admission						
No	1.00					
Yes	0.76	0.69	0.84	0.99	0.89	1.09
On Aspirin at Time of Stroke						
No	1.00					
Yes	1.14	1.06	1.23	0.98	0.91	1.06
On Warfarin at time of Stroke						
No	1.00					
Yes	1.40	1.22	1.60	1.45	1.27	1.66
Atrial Fibrillation						
No	1.00					
Yes	2.09	1.94	2.25	1.35	1.25	1.46
Haemorrhage on Scan						
No	1.00					
Yes	2.13	1.94	2.33	1.66	1.51	1.82
Stroke Unit within 1 day						
no	1.00					
yes	0.88	0.80	0.97	1.11	1.02	1.22
Stroke Unit care at any stage*						
no	1.00					
yes	0.74	0.68	0.80	0.69	0.63	0.74
CT Scan within 2 days						
no	1.00					
yes	0.86	0.79	0.93	1.01	0.93	1.10
Aspirin given in Hospital						
no	1.00					
yes	0.40	0.37	0.43	0.45	0.42	0.48
Swallow Screen carried out						
no	1.00					
yes	1.10	1.00	1.21	0.76	0.69	0.84

* Only cases where patient has survived at least 7 days included

Cox regression using forward selection - final model ; variables in equation

4.7 Capturing audit data as part of routine care

The project's IT developer worked closely with the clinical lead for the audit to develop a web based clinical programme to support a neurovascular clinic to test the practicality of capturing audit data as a by-product of clinical care – in line with NHS QIS strategy for national audit. A system based on an outpatient service was chosen because it was thought to be easier to implement than an inpatient system. Neurovascular clinics involve fewer doctors than inpatient services so that the requirement for training in the use of any IT system is less.

The system went live in the Western General Hospital, Edinburgh, in December 2005. It comprised an appointment management system and a clinical system. Clinicians entered patients' data directly into the system during the consultation. This enables the clinician to print:

- completed request cards for investigations
- patient information sheets to hand to the patient
- a complete record to be placed in the medical notes
- a letter for the general practitioner
- a copy of the letter for the patient if requested.

The clinicians in both the Western General Hospital and Edinburgh Royal Infirmary have taken up the system readily because it provides useful output. In addition to being used in the neurovascular clinic, it has been adapted and used by Specialist Registrars in Stroke medicine seeing patients in the emergency departments and by consultants on the combined assessment wards. Thus data relevant to the audit are being collected on a substantial proportion of patients coming through these two hospitals, even when they are not admitted.

The clinical system does not currently link to Patient Information Systems (because these have changed during the project), to SCI Store to allowed transfer of results of investigations, or to primary care systems. Such links would greatly enhance its utility and are things for the future (see Section 7).

5 Discussion

This project has shown that it is possible to carry out an audit of the process of care for stroke patient across all NHS Boards and involving all relevant hospitals. These hospitals have collected a minimum dataset which has allowed comparisons to be made between NHS Boards and hospitals and also to show changes in adherence to standards over time. Indeed, the data from SSCA were used by every NHS Board in completing the self assessment questionnaires for the NHS QIS review of stroke services published in 2005.

The audit has evolved over the funding period. It has involved far more hospitals than originally planned and over time their audit methods have developed. Some hospitals also started to collect data on outpatients. The introduction of a quality assurance co-ordinator was associated with the development of more robust data collection systems in some hospitals. Some NHS Boards developed more radical methods. For example, in Lanarkshire they moved to a web based IT system to capture, analyses and present their data.

The numbers of patients included in the audit increased over time. This was in part due to additional hospitals joining the audit but probably also due to improvements in hospitals case finding rather than a true increase in numbers of hospitalised patients.

Overall the audit suggests that the process of care has improved with respect to all of the major indicators across Scotland (Table 4). The reasons for the improvements in the percentage of patients managed in accordance with the NHS QIS standards are uncertain. The national figures could be distorted by the inclusion of more patients from hospitals with better performance in the later time period. However, the performance by hospital and NHS Board, as presented in the national reports,[12,13] make it unlikely that this is a major reason. The increased proportion of patients managed in a stroke unit, and the earlier admission to stroke unit care is likely to make management according to guidelines more easily implemented since it involves staff who are trained in stroke care rather than staff working on general wards. By 2004/5[12,] almost all hospitals regularly admitting acute stroke patients had a stroke unit – the only exceptions were in Orkney and Shetland. In 2002 there were 31 stroke units and 583 stroke unit beds in Scotland. By 2005 there were 46 stroke units with a total of 789 designated stroke beds. Of these 46, 13 (28%) were acute, 20 (43%) were rehabilitation, 12 (26%) were combined and one was a hyperacute monitoring unit. Most stroke units have written protocols or integrated care pathways. The improvements are unlikely to be due to chance given the non-overlapping confidence intervals.

An annual meeting was held to present the audit data and share good practice. However, at the same time MCNs were established and the Scottish Executive increased investment in stroke services. Thus several initiatives could individually or in combination be responsible for the observed improvements. Not all NHS Boards and Hospitals demonstrated improvements in all areas but these hospital specific data (see National Report 2005/2006[13]) provide targets for hospitals to aim for.

The audit has demonstrated major variations between NHS Boards and individual hospitals in the proportions being managed according to national standards (see National Report 2005/2006[13]). These data suggest that all NHS Boards have plenty of scope for improvement and none meet all the standards set. The audit needs to continue in order to ensure that performance continues to be monitored and managed properly.

The accuracy of these audit data depends upon the rigour with which they are collected and a number of methodological factors which could distort the data are described below:

Incomplete case ascertainment: If the methods for identifying all patients admitted with stroke, or having a stroke whilst in hospital, are not applied rigorously then the total number of cases identified may be lower than expected. It is likely that stroke patients admitted to a stroke unit will be more easily identified for the audit than those admitted elsewhere or having a stroke on another ward. Patients in stroke units are probably more likely to be managed according to protocols so if the proportion admitted to a stroke unit is inflated (because those not admitted to stroke unit are missed) then this will increase the proportion having certain aspects of stroke care such as swallowing assessments and appropriate secondary prevention. Thus apparently good performance with respect to stroke care may actually reflect less good stroke care disguised by poor ascertainment in the audit.

Over the period of the audit the numbers of patients included rose, suggesting that overall case ascertainment improved since it is very unlikely that the actual numbers of stroke patients admitted to hospital rose over this time. The ageing population will account for small increases in the numbers of stroke occurring in the population but the year on year rise will be small and in part offset by the falling age-specific stroke incidence demonstrated in community based incidence studies. There probably has been a lowering in the threshold for admission over the last couple of decades due to a perception that patients with stroke require more investigation and are likely to benefit from specialist care. However, it is unlikely that this would account for the large changes seen over a short time period. Improved case ascertainment is likely to be associated with reductions in the proportions of patients being treated according to standards because it will be associated with inclusion of patients who are not managed within a stroke unit (see above). The audit may therefore have under-estimated actual improvements in patient care.

Although incomplete case ascertainment may be indicated by a large discrepancy between the numbers identified in the audit and the numbers identified from SMR01 this is not necessarily the case. We know that routine coding of stroke is often inaccurate. Sometimes there are long delays between patients' discharge and notification of SMR01 data to ISD. This may lead to significant under estimates of the numbers of patients admitted if the audit period ended recently.

Failure to track patients through to discharge: Patients for whom date of discharge (or date of death if died in hospital) is not recorded are not included in these analyses. This is perfectly valid where the patient has really not been discharged. Failure to collect date of discharge for patients who have actually been discharged (or died) could lead to patients being incorrectly excluded from these analyses. This is most likely to affect long stay patients. It is also more likely to affect patients who are not in a stroke unit at the time of discharge. This may introduce a small bias into the figures, particularly for the proportions receiving discharge medications.

Inadequate input from clinicians: It is often difficult to decide from the clinical notes whether a patient has had a stroke or not. If the audit co-ordinator does not have adequate support from a senior clinician patients may either be inappropriately included or excluded. Since such patients may be managed differently from those with more definite stroke this may influence overall estimates of performance. This problem contributes to the inaccuracy of routine coding in SMR01. Most coding is done by coders and based on discharge summaries produced by relatively inexperienced medical staff. The latter usually have no understanding of the impact that their summaries can have on the coding, or indeed the importance of accurate coding.

Incomplete or unclear recording of process in clinical notes: Most participating hospitals rely on audit co-ordinators to extract these data items from the clinical notes. If the notes do not reflect the process of care then neither will the audit. Also, if the process is recorded but the notes are poorly organised the auditor is more likely to overlook the record. This may lead to an overly pessimistic view of care. In centres that use structured notes and proformas this is less likely to happen. Some of the improvements seen in the process of care could result from introduction of more structured notes which facilitated the recording of the process or the extraction of these data. Appropriate proformas are less likely to be in use outside specialised stroke units, so this could be a further cause of slight bias.

Deviation from minimum dataset: A few centres did not collect all of the standard data items or did not use the standard format meaning that calculations of performance derived from these specific data items was not possible.

Failure to adhere to definitions and coding rules: Inevitably if the definitions shown in Appendix C were not adhered to, or the items were not coded in SSCAS as indicated it could distort the estimates of performance. Neither we nor the hospitals had the resources to check adherence to the definitions. We hope that the introduction of clinical systems which demand that standard definitions and codes are used, as per the work of the National Clinical Dataset Development Programme (NCDDP), will reduce this potential bias in future audits.

Difficulties with audit staff: There were a variety of staffing issues that could have affected the completeness and quality of data. In some instances sickness, maternity leave, holidays and replacing departing staff may have left gaps in the data collection that could make it difficult to interpret the data. It is unlikely that hospitals will invest more heavily in the audit to ensure continuity and completeness of data collection. The future has to depend on capturing the data as a by-product of clinical care (see 4.5) to improve the efficiency of the audit process.

The rigour with which the audit was carried out varied considerably between hospitals. This depended on the local resources available, the complexity of the stroke services and the enthusiasm of the staff involved.

We have endeavoured to minimise the differences in methodological rigour between centres by providing a detailed guide on how to do the audit, standardised software and visits from a quality assurance facilitator to work with staff to develop a local Standard Operating Procedure. It is difficult to know how successful these initiatives were in reducing variations between centres since we did not have the resources to independently check their data.

In this report and our National Reports we have avoided commenting on the "performance" of individual NHS Boards or hospitals since we cannot easily estimate what contribution to the variation was made by audit methodology as opposed to the actual process of care. In the National Report individual Managed Clinical Networks within the NHS Boards have added their comments to explain their results (Appendix B of report). These indicate that the audit is having a major impact on stroke services and MCNs are making use of the data. Each MCN has a quality assurance framework which requires that data are collected to indicate whether the services are improving. The audit data are being used locally to monitor services and drive forward improvements. A minority of NHS Boards identify significant local problems with their data collection and are striving to improve these.

6 Conclusions

1. Routinely monitor the performance of Scottish hospitals against nationally agreed standards for stroke care identified by the Scottish Stroke Standards Group and CSBS.
   - The audit has enabled hospitals to monitor their performance against NHSQIS standards.
2. Monitor progress against goals set by the strategy developed by the CHD & Stroke Reference group.
   - The audit has provided data to indicate the progress made against the Stroke Strategy.
3. Facilitate an ongoing programme of national time limited audits in specific aspects of stroke care directed by the Intercollegiate Scottish Stroke Collaboration.
   - The audit completed a time limited audit of the screening for safety of swallowing.
4. Enhance the value of collecting routine outcome indicators for stroke by collecting data to allow fuller adjustment for variations in casemix.
   - The audit has provided 6 month case fatality rates adjusted for casemix.
5. Improve the accuracy of routinely collected hospital discharge data.
   - The audit has provided data to allow services to examine the reasons for mismatch between audit and routinely collected data.
6. Drive improvements in the organisation and delivery of stroke care and encourage sharing of good practice and adherence to best evidence.
   - Annual meetings have been held where good practice has been shared. MCNs have indicated that they are acting on the results of the audit to drive forward service improvements.

Later these additional aims were added:

7. Bolster hospitals systems for Quality Assuring the audit data.
   - The audit helped each hospital develop a Standard Operating procedure for the audit
8. Develop software systems that encourage real time collection of audit data (it was hoped that if the system could generate discharge summaries and clinic letters this would encourage earlier data collection and reduce longer term reliance on audit staff).
   - The audit has demonstrated the practicality of collecting data relevant to the audit as a by-product of clinical care.

Lessons Learned which may be applicable to other national audits

- It is important and possible to agree a minimum dataset across a disease specific service in Scotland. In future these datasets should be developed in partnership between the relevant professionals and the NCDDP.
- A common IT system to support and standardise the capture, storage and analysis of data is vital.

- Hospitals and NHS Boards have to "buy in" to the audit and be prepared to commit the necessary resources to it. Linking the audit with a national strategy or an NHS QIS review will focus the attention of management in NHS Boards on the issue and is more likely to ensure appropriate resources are identified. Audit staff should work within a management framework that ensures that the work is done even when staff are on leave. Clinicians need to be given the time (e.g. programmed activities) to participate in the audit. In addition we identified that the audit is most successful where there is involvement of senior medical and nursing staff.
- NHS QIS standards should be defined in a way which allows hospitals performance against them to be reliably measured. For example, there is little point in defining maximum delays in hours when audit systems can only reliably record dates.
- A model based on each hospital running its own audit but with central collation of the data to produce a national report is feasible and affordable though ensuring the quality of data is more difficult than with a national audit co-ordinated and run from the centre e.g. the now completed Scottish Trauma Audit Group (STAG). We believe that hospitals are more likely to believe the results of *their* own data collection and are therefore more likely to respond to *their* results.
- The process of capturing data necessary for audit can be improved. The development of clinical IT systems linked to the current PAS and Scottish Care Information (SCI) systems should ensure that the majority of the data will be captured as a by-product of clinical care.
- National audits can, in the right context, be a powerful tool to improve services for patients.

7 Recommendations For The Future

Funding of the National Audit is to continue and from 1 August 2006 will be provided by the Scottish Executive. An IT and audit subgroup of the National Advisory Committee for Stroke has been established to co-ordinate several inter-related pieces of work which should facilitate the audit in the future and the development of clinical systems which will capture the majority of the data as a by product of clinical care and thus reduce the resources required for local data capture. These include:

- The Scottish Stroke Care Audit
- Completion of the National Clinical Dataset Development Programme (NCDDP) co-ordinated by ISD, specifically their work developing standards for the recording of clinical data for stroke. (http://www.clinicaldatasets.scot.nhs.uk/). This work is key to establishing clinical IT systems which can communicate across health care organisations.
- Bringing together teams who are developing Clinical IT systems to support their service delivery and which might provide models for developing a National Clinical Stroke System built using the Generic Clinical System Toolkit, a system purchased by the Scottish Executive to facilitate development of clinical systems.

The IT coordinator of the audit has now been trained in the use of the Generic Clinical System Toolkit and has been given access to it. He will work with members of the IT & audit group to develop a core clinical system which will not only support clinical care but also collection of the audit data. He will apply the lessons learnt from developing our neurovascular clinic system in Lothian. Hopefully these systems will become available in the next couple of years. However, it is important to maintain the audit in this period of development.

Ongoing central coordination and local support for the audit is required. The latter needs to be strengthened in those NHS Boards where data capture is either incomplete or delayed. The process of using data and clinical audit to drive service improvements is an important way to support patient care. Central coordination is required to maintain common standards for data collection and use, to ensure that there is external benchmarking of performance, and to provide a national view of performance to track progress against the NHS QIS Stroke Standards and the aspirations of the National Stroke Strategy.

Audit data might be quality assured in several different ways with varying implications for resource requirements. The most expensive would be to check the accuracy of a random sample of patient records but this would not deal with the potential problem of under-ascertainment. More realistically one can look at the internal consistency of data within a service. For instance do the numbers of patients entered remain fairly stable and are they similar to data from SMR01 or consistent in their relationship to SMR01. Hopefully in the future, as the audit data are collected as a by-product of clinical care, accuracy will be improved because of the need to ensure that information on which clinical decisions are made is accurate.

8 Dissemination

There have been three National Meetings hosted by the audit in conjunction with the Royal College of Physicians. These meetings provided a forum to disseminate the results of the audit, share new methods of collecting data on stroke care in Scotland and allowed the different stakeholders working on stroke care in Scotland (including, consultants, nurses, audit coordinators, allied health professionals, government groups and patients) the opportunity to network.

The audit has produced two National Reports and plans to continue to produce National Reports[12, 13] annually whilst funding continues. These provide individual hospitals with an external benchmark and allow the Scottish Executive to monitor progress against its strategy. These reports are posted on the SSCA website and were distributed to all NHS Boards and the Scottish Executive. The Minister for Health has used data from the 2004/2005 report to answer parliamentary questions and in the future data from the report will be used by NHS QIS to track progress against their Clinical Standards for Stroke Services

This final report will be posted on our website, a hard copy will be sent to our Steering Committee, and hard copies will be sent out to stakeholders.

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Appendix A: Scottish Stroke Care Audit Project Group

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Appendix C: Core and Minimum Datasets

Core Dataset Definitions

Field Name	Definition
Patient identifier (Chi)	Accurate patient identification is crucial to achieving accurate figures. This is because patients may return to the same hospital, may move to a different hospital catchment, or may be referred from one hospital to another. We may wish to link across units and avoid counting any patient more than once. Many different identification systems are in use. We have experienced many problems in the past with systems which use supposedly unique identifiers but where an individual patient has more than one number. Matching patients across different systems is often difficult. The NHS in Scotland has recognised these problems. Community Health Index ('CHI') numbers are being introduced, giving a patient a unique, national, reference number 'from the cradle to the grave'. This blessing could not have arrived at a better time for our system. We recommend using CHI numbers as patient reference numbers. Where CHI numbers are not immediately available users may use another number, or the system can be asked to generate a unique number, for temporary use. When a CHI number becomes available, that can be used to replace the temporary number. Similar steps are being taken in other parts of the UK. In England, 'new NHS' numbers are being introduced to fulfil the same function as CHI numbers. These will be acceptable to the system which is designed to cope with patients from any origin required.
Surname	Patient's surname or family name is mandatory for the system. From the COPPISH SMR Data Manual version 1.1; issued November 1995 p2-5: "The surname of a person represents that part of the name of a person which indicates the family group of which the person is part." When recording names be aware of different conventions for order for parts of the name used in different cultures.
Forename	Patient's forename or given name is mandatory for the system. From the COPPISH SMR Data Manual version 1.1; issued November 1995 p2-6: "The first forename of a person represents that part of the name of a person which, after the surname, is the principal identifier of a person." When recording names be aware of different conventions for order for parts of the name used in different cultures.
Sex	Patient's sex or gender is mandatory for the system. Sex is entered as M or F. There is no coding, and there is no way of saying 'don’t know' ! How to record sex change ? COPPISH also allows don't know, giving e.g. newborn babies; not specified. Extra options required ?
Date of birth	Date of birth is mandatory for the system.
Postcode sector	Postcode sector is that part of the patient's postcode excluding the last two characters (the 'Unit') from their usual address. Strictly the sector as described here comprises Area, District and Sector (see http://www.ex.ac.uk/cimt/resource/postcode.htm). Storage of sector alone is not considered to compromise patient confidentiality as it is too imprecise to be used to identify individuals. The sector can be used to establish Deprivation scores in Scotland using the Carstairs index.

	The patient's usual address is defined in the COPPISH SMR Data Manual version 1.1; issued November 1995 p2-16 : "A patient's usual address is the address at which (s)he currently lives and which the patient states is his/her current address."
Date of initial assessment	Date of clinical examination from which baseline data for the system has been (mainly) drawn.
Hour of initial assessment	Time - hour of clinical examination from which baseline data for the system has been (mainly) drawn.
Minute of initial assessment	Time - minute of clinical examination from which baseline data for the system has been (mainly) drawn.
Responsible clinician	Select the value required from the list. If you can't see the list, activate the list by clicking the arrow (pointed downwards) on the right side of the window. If the value you want is not shown, see the person responsible for the study or the system supervisor.
Where seen	In what context was the patient seen when initially examined. This can be in a hospital as either an Inpatient or as an Outpatient. It could also be at a GP clinic, at home (normal place of residence) or at some other place away from a hospital. Select the value required from the list. If you can't see the list, activate the list by clicking the arrow (pointed downwards) on the right side of the window. If the value you want is not shown, see the person responsible for the study or the system supervisor.
Unit where seen	Select the value required from the list. If you can't see the list, activate the list by clicking the arrow (pointed downwards) on the right side of the window. If the value you want is not shown, see the person responsible for the study or the system supervisor.
Date of Admission	Date of admission to hospital (if relevant).
Hour of Admission	Time - hour of admission to hospital (if relevant).
Minute of Admission	Time - minute of admission to hospital (if relevant).
Admitted from	Type of facility admitted from. Coded as per COPPISH codes.
Discharged to	Type of facility Discharged to. Coded as per COPPISH codes.
Discharge date	Date discharged from hospital (alive) if relevant.
Postcode sector on admission	Patient postcode is required for two purposes. The whole postcode is required when postal contact with the patient is required. The last two characters of a postcode (the 'unit') are not required for any other purpose. The rest of the postcode (Area, District and Sector - loosely referred to as the 'sector') is required to derive deprivation category. In Scotland, this is done using Carstairs scores. The 'sector' at admission must be entered. To meet these two requirements, two versions of the postcode are stored. The whole postcode is stored for contacting the patient. This is updated as required to keep current contact details correct. The postcode sector at admission (or examination if not admitted) is stored separately for calculating deprivation category. This is retained, regardless of subsequent changes to the patient's address.

Final diagnosis Stroke	Whether final diagnosis included stroke. (Further details may be recorded in the Disease Classification section).
Final diagnosis TIA	Whether final diagnosis included Transient Ischaemic Attack. (Further details may be recorded in the Disease Classification section).
Final diagnosis SAH	Whether final diagnosis included SubArachnoid Haemorrhage. (Further details may be recorded in the Disease Classification section).
Final diagnosis RAO	Whether final diagnosis included Retinal Artery Occlusion. (Further details may be recorded in the Disease Classification section).
Final diagnosis AFx	Whether final diagnosis included Amaurosis Fugax. (Further details may be recorded in the Disease Classification section).
Final diagnosis Possible CVD	Whether final diagnosis included Possible cerebrovascular disease. Use if presentation could have cerebrovascular cause but < 50% certain and give details (e.g. lone vertigo).
Details of other diagnosis	Whether final diagnosis included possible cerebrovascular diagnosis. Further details may be recorded in the text box alongside. In addition, the Disease Classification section can be set up to record specific details to suit your requirements.
Final diagnosis Other	Whether final diagnosis included other, non-cerebrovascular diagnosis. Further details may be recorded in the text box alongside. In addition, the Disease Classification section can be set up to record specific details to suit your requirements.
Details of other diagnosis	When final diagnosis includes other, non-cerebrovascular diagnosis, further details may be recorded here.
End data collection	Select a value to end data collection for this patient. On this form the only relevant value is probably 'Death'. Once a value is recorded, no new data collection will be initiated, though the system will continue to attempt to collect data for previous requests. In any case, select the value required from the list. If you can't see the list, activate the list by clicking the arrow (pointed downwards) on the right side of the window. If the value you want is not shown, see the person responsible for the study or the system supervisor.
Date finished collection	This is the date after which no new data collection is to be initiated.

Minimum Dataset Definitions

Field Name	Definition
Patient identifier (CHI)	Community Health Index ('CHI') numbers are being introduced in Scotland, giving a patient a unique, national , reference number 'from the cradle to the grave'. We recommend using CHI numbers as patient reference numbers. Where CHI numbers are not immediately available users may use another number. When a CHI number becomes available, that can be used to replace the temporary number. Similar steps are being taken in other parts of the UK. In England, 'new NHS' numbers are being introduced to fulfil the same function as CHI numbers. These will be acceptable to the system which is designed to cope with patients from any origin required.
Case reference	Current hospital (provider unit) case reference for patient.
Surname	From the COPPISH SMR Data Manual version 1.1; issued November 1995 p2-5: "The surname of a person represents that part of the name of a person which indicates the family group of which the person is part."
Forename	From the COPPISH SMR Data Manual version 1.1; issued November 1995 p2-6 : "The first forename of a person represents that part of the name of a person which, after the surname, is the principal identifier of a person." When recording names be aware of different conventions for order for parts of the name used in different cultures.
Sex	Male or Female
Date of birth	Date the patient was born
Date and Time of Initial assessment	Date and time of clinical examination from which baseline data for the system has been (mainly) drawn.
Responsible clinician	This should be the consultant under whose care the patient was at the time of hospital discharge.
Unit where seen	Identity of hospital or other provider unit where the patient was assessed.
Seen as	In what context was the patient seen when initially examined. This can be in a hospital as either an Inpatient or as an Outpatient. It could also be at a GP clinic, at home (normal place of residence) or at some other place away from a hospital. Never seen as an Outpatient should be used where a patient has been referred for an event or events, but has never been seen in relation to that event or events. Thus it can be used even if a patient has been seen for a separate event or events. This code is intended to allow a Unit to audit the number of referrals received, including those where the patient is never seen.
Date and Time of Admission	This should refer to date and time of arrival at the hospital rather than the date when the decision to admit was made or the date when the patient actually entered the ward. It is likely to be recorded in the Accident & Emergency department. If the event concerned occurred when the patient was already in hospital for another condition, the date of the original admission should be given. Dates of admission prior to event can easily be identified at analysis.

Field Name	Definition
Admitted from	Type of facility admitted from. Coded as per COPPISH codes. The patient's place of residence is required. For instance, patients taken ill in the street should be coded as "admitted from home". COPPISH codes have commonly been mis-applied here (1). Patients taken ill in the street have been incorrectly coded as "admitted from other". Where a patient has a stroke when they are already in hospital for another condition, code the patient's place of residence when originally admitted to hospital.
Discharge date	Date discharged from hospital (alive) if relevant.
Discharged to	Type of facility Discharged to. Coded as per COPPISH codes.
Postcode sector	Postcode sector is that part of the patient's postcode excluding the last two characters (the 'Unit') from their usual address. Strictly the sector as described here comprises Area, District and Sector (see http://www.ex.ac.uk/cimt/resource/postcode.htm). Storage of sector alone is not considered to compromise patient confidentiality as it is too imprecise to be used to identify individuals. The sector can be used to establish Deprivation scores in Scotland using the Carstairs index.
Stroke	Whether final diagnosis included stroke. (Further details may be recorded in the Disease Classification section).
Transient ischaemic attack	Whether final diagnosis included Transient Ischaemic Attack. (Further details may be recorded in the Disease Classification section).
Sub-arachnoid haemorrhage	Whether final diagnosis included SubArachnoid Haemorrhage. (Further details may be recorded in the Disease Classification section).
Retinal artery occlusion	Whether final diagnosis included Retinal Artery Occlusion. (Further details may be recorded in the Disease Classification section).
Transient monocular blindness	Whether final diagnosis included Amaurosis Fugax. (Further details may be recorded in the Disease Classification section). Amaurosis Fugax refers to any episode of monocular visual loss (complete or partial) lasting less than 24 hours and which is presumed to be due to retinal ischaemia (not venous occlusions). Retinal venous occlusions should be coded as non-cerebrovascular disease.
Possible cerebrovascular	Whether final diagnosis included Possible cerebrovascular disease. Use if presentation could have cerebrovascular cause but < 50% certain and give details (e.g. lone vertigo).
Possible cerebrovascular Details	Whether final diagnosis included possible cerebrovascular diagnosis. Further details may be recorded in the text box alongside. In addition, the Disease Classification section can be set up to record specific details to suit your requirements.
Definite non-cerebrovascular	Whether final diagnosis included other, non-cerebrovascular diagnosis. Further details may be recorded in the text box alongside. In addition, the Disease Classification section can be set up to record specific details to suit your requirements.
Definite non-cerebrovascular: Details	When final diagnosis includes other, non-cerebrovascular diagnosis, further details may be recorded here.
Date of Onset	This is the best estimate of the date of onset of the patient’s focal cerebral symptoms based on all available information. If patients do not have focal cerebral symptoms (e.g. just headache with subarachnoid or intracerebral haemorrhage) the onset of the predominant symptom should be recorded. If a patient has non-focal symptoms prior to development of focal cerebral symptoms or deficits do not code the date of onset of these as the date of stroke onset.

Field Name	Definition
Was the patient independent in ADL before event	Patients should be independent (i.e. not need help from any person) in activities which would normally be performed everyday i.e. walking (at least around their house), washing, dressing, feeding (not meal preparation) and toileting. For the purposes of this classification we do not include activities which are carried out less frequently and where dependency is highly dependent on the environment (e.g. bathing vs. showering, shopping depends on distance from shops, stairs depends on type of living accommodation). This will hopefully lead to better agreement than leaving it up to the individual rater to decide what 'everyday activities' means.
Was the patient living alone at the time of event	If they are living away from their normal place of residence temporarily - e.g. on holiday or in hospital - please be sure to code their NORMAL place of residence, not their temporary place of residence. If the patient is living in a residential or nursing home they should not be coded as living alone. If they live alone in a warden controlled apartment then this can be coded as living alone.
Can the patient talk	Is the patient able to talk? Should the patient be unassessable for any reason code 'NO' (abnormal).
Are they orientated in time, place and person	Can the patient tell you their name, the place and time correctly (Y or N)? This question is based on the verbal component of the Glasgow Coma Scale, where: 5 = orientated 4 = confused 3 = inappropriate words 2 = groans 1 = none If 5 record as 'Yes' (orientated), otherwise record as 'No' (including patients who are unassessable for any reason).
Can the patient lift both arms off the bed	We do not stipulate that they should be able to keep them off the bed for any specific period or lift them to the horizontal. Should the patient be unassessable for any reason code 'NO' (abnormal). Should the unaffected arm be completely missing, code the affected arm only. Should the affected arm be completely missing, code on the affected leg instead, if possible, otherwise code 'NO'.
Able to walk without help from another person	Is the patient able to walk without the aid of another person (Y or N)? They may use any other aid.
Current AF confirmed on ECG	Refers to atrial fibrillation (AF) which is proven on an ECG at the time of assessment or during any hospital inpatient stay. Please also include AF proven on ECG at any time between the event for which they are being assessed and the current assessment. It should not include atrial flutter for which there is less robust evidence for the effectiveness of anticoagulation in stroke prevention.
Aspirin at onset	Had the patient taken aspirin in the 24 hours prior to the onset of stroke symptoms?
On Warfarin at onset	Whether the patient had been prescribed Warfarin prior to and at the time of first symptoms. This is a question related to patient management, please ignore complications relating to compliance.
Was the patient managed in an acute Stroke Unit	An acute stroke unit is defined as a specific ward or part of a ward where patients with acute stroke are admitted either directly from the community, from the accident & emergency department or after a brief (usually <24 hours) stay in a medical assessment area.

Field Name	Definition
Entry to acute SU	Date of entry to acute Stroke Unit, from any source - e.g. acute receiving unit or from another ward or hospital.
Exit from acute SU	Date when patient moves out of acute stroke unit whether it is to home or another ward or hospital.
Unit	Identity of hospital or other provider unit containing the acute Stroke Unit.
Consultant	This should be the consultant under whose care the patient was while in this unit.
Was the patient managed in a rehab Stroke Unit	A stroke rehabilitation unit is a ward or part of a ward which is designated specifically for the rehabilitation of patients with stroke and in which the majority of patients will have had a stroke. Multidisciplinary team meetings should take place at least weekly and the staff will have received specific training in stroke.
Entry to rehab SU	Date of entry to rehab unit, from any source - e.g. stroke unit or from another ward or hospital.
Exit from rehab SU	Date when patient moves out of stroke rehabilitation unit whether it is to home or another ward or hospital.
Unit	Identity of hospital or other provider unit containing the Rehabilitation Stroke Unit.
Consultant	This should be the consultant under whose care the patient was while in this unit.
Was the patient managed in a rehab unit	A normal rehabilitation unit is a ward or part of a ward which is designated specifically for the rehabilitation of patients with no particular emphasis on any disease or condition.
Entry date	Date of entry to rehab unit, from any source - e.g. stroke unit or from another ward or hospital.
Exit date	Date when patient moves out of rehabilitation unit whether it is to home or another ward or hospital.
Unit	Identity of hospital or other provider unit containing Rehabilitation Unit.
Consultant	This should be the consultant under whose care the patient was while in this unit.
Whether Aspirin given in hospital	This should be completed by reference to the drug chart. A patient may have been using aspirin but this is stopped on / immediately after admission for any reason, e.g. pending results of CT or other tests. In these circumstances, ignore this use of aspirin when considering how to answer this question. If aspirin is restarted, answer Yes, and enter the date restarted as date started. If not restarted, enter No. If a patient has been using aspirin and this is continued without break, enter Yes, with the date of admission as the date started. If a patient is never given aspirin answer No. If newly prescribed aspirin, enter Yes with the date started. If the patient is being audited for a stroke that occurred when they were already in hospital, only that period after their stroke should be considered. In other words, the time of stroke should be treated as the time of admission to hospital when considering how to answer this question.

Field Name	Definition
Date Aspirin started	Date aspirin first given after hospital admission or after the stroke onset if stroke occurred in hospital. This should be completed by reference to the drug chart. A patient may have been using aspirin but this is stopped on / immediately after admission for any reason, e.g. pending results of CT or other tests. In these circumstances, ignore this use of aspirin when considering how to answer this question. If aspirin is restarted, enter the date restarted as date started. If a patient has been using aspirin and this is continued without break, enter the date of admission (or onset if stroke occurred in hospital) as the date started. If newly prescribed aspirin, enter the date started
Final Discharge from hospital on Aspirin	Did aspirin appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
Final Discharge on Clopidogrel (Plavix)	Did Clopidogrel (Plavix) appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
Final Discharge on Dipyridamole (Persantin)	Did Dipyridamole (Persantin/Asasantin) appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
Final Discharge on Warfarin	Did Warfarin appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
Final Discharge on an ACE inhibitor	Did an ACE Inhibitor appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
Final Discharge on a Diuretic	Did a Diuretic appear on the discharge prescription or list of drugs which the patient should have been taking after discharge. Diuretic is defined as a drug given with the defined intention of increasing urine flow from the kidneys.
Final Discharge on another anti-hypertensive	Did another anti-hypertensive appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
Final Discharge on a Statin	Did a Statin appear on the discharge prescription or list of drugs which the patient should have been taking after discharge.
CT	Computerised tomography of the brain.
CT Date	Date of first CT after stroke onset.
MRI	Magnetic Resonance Imaging scan of the brain.
MRI Date	Date of first MRI after stroke onset.
Evidence of new haemorrhage on scan	Based on either review of actual scan or the radiologists report. Please include haemorrhage which is thought to be secondary to cerebral infarction i.e. haemorrhagic transformation of infarction. If there are only vague signs of possible petechial haemorrhage into an infarction it would be reasonable to code haemorrhage as being absent. In this field we are trying to establish whether there was a definite contra-indication to antithrombotic medication given and acknowledge the difficulties of distinguishing primary haemorrhage from that into an area of infarction.
Classification of Stroke Syndrome	This refers to the clinical syndrome at the time of maximal deficit. Coding should take account of the results of imaging where available.
ICD 10 final diagnosis	Pick the most appropriate and specific International Classification of Diseases version 10 code from the list provided.

Field Name	Definition
Swallow screen recorded	A two stage assessment aimed to establish first whether it is safe to proceed with a formal assessment of swallowing safety and second to determine, using a simple water swallow test, whether the patient can safely be given free oral fluids and food. Failure on either part should lead to the patient being put 'nil by mouth' and given at least hydration and sometimes nutrition via an alternative route until a formal assessment by a speech and language therapist. The fact that a screening test for swallowing problems has been carried out and its results, should be documented in the medical notes.
Swallow screen Date	Date first Swallowing assessment performed.

Appendix D – Start and end dates

SSCA data linked with SMR01 data

Hospital	Start date	End date
Crosshouse Hospital	25/02/2004	28/03/2006
The Ayr Hospital	12/11/2003	18/02/2006
Borders General Hospital	03/01/2004	31/12/2005
Lorn & Islands District Gen Hospital	04/08/2003	01/11/2005
Vale of Leven District General Hospital	04/08/2003	18/12/2005
Inverclyde Royal Hospital	03/08/2003	19/02/2006
Royal Alexandra Hospital	31/01/2003	13/02/2006
Victoria Hospital	08/12/2003	20/03/2006
Queen Margaret Hospital	19/12/2003	25/02/2006
Glasgow Royal Infirmary	14/06/2004	16/01/2006
Stobhill Hospital	01/06/2004	23/01/2006
Victoria Infirmary	01/04/2004	15/03/2006
Southern General Hospital	19/03/2004	05/03/2006
Western Infirmary/Gartnavel General	01/06/2004	17/12/2005
Caithness General Hospital	05/09/2003	09/06/2005
Raigmore Hospital	05/06/2003	23/01/2006
Belford Hospital	17/02/2004	13/04/2005
Monklands Hospital	15/08/2003	02/04/2006
Hairmyres Hospital	22/08/2003	27/03/2006
Wishaw General Hospital	04/09/2003	31/03/2006
Aberdeen Royal Infirmary	30/07/2000	20/02/2006
Woodend General Hospital	28/09/2000	07/06/2004
Dr Gray's Hospital	02/10/2000	24/03/2002
Balfour Hospital	26/02/2004	11/05/2005
Royal Victoria Hospital	22/09/2001	29/10/2005
Western General Hospital	07/02/2001	27/01/2006
Royal Infirmary of Edinburgh	07/05/2001	02/10/2004
St John's Hospital At Howden	01/05/2001	22/03/2006
Inchkeith House	30/04/2003	24/12/2003
Royal Infirmary of Edinburgh at Little France	09/12/2002	01/09/2005
Ninewells Hospital	09/01/2004	16/02/2006
Perth Royal Infirmary	18/03/2003	22/02/2006
Falkirk and District Royal Infirmary	01/07/2003	12/02/2006
Stirling Royal Infirmary	26/06/2003	06/04/2006
Western Isles Hospital	16/06/2002	21/03/2006
Uist & Barra Hospital	10/11/2004	02/01/2006
Dumfries & Galloway Royal Infirmary	02/01/2003	13/03/2006
Gilbert Bain Hospital	06/02/2004	30/12/2004

SSCA Scotland data periods by hospital – Inpatients

	2003/2004		2004/2005	
Hospital	**Start Date**	**End Date**	**Start Date**	**End Date**
Crosshouse Hospital	01/03/04	31/10/04	01/11/04	31/10/05
The Ayr Hospital	01/01/04	31/10/04	01/11/04	31/10/05
Borders General Hospital	01/01/04	31/12/04	01/01/05	31/12/05
Lorn & Islands District Gen Hospital	01/09/03	31/08/04	01/09/04	28/02/05
Inverclyde Royal Hospital	01/09/03	01/09/04	01/09/04	31/08/05
Royal Alexandra Hospital	01/09/03	31/08/04	01/09/04	31/08/05
Victoria Hospital	08/12/03	07/06/04	08/06/04	07/06/05
Queen Margaret Hospital	08/12/03	07/06/04	08/06/04	07/06/05
Glasgow Royal Infirmary	01/09/04	28/02/05	01/03/05	28/02/06
Stobhill Hospital	01/09/04	28/02/05	01/03/05	28/02/06
Victoria Infirmary	05/04/04	05/10/04	06/10/04	05/10/05
Southern General Hospital	05/04/04	05/10/04	06/10/04	05/10/05
Western Infirmary/Gartnavel General	01/09/04	28/02/05	01/03/05	28/02/06
Caithness General Hospital	not collected	not collected	01/09/03	01/05/06
Raigmore Hospital	01/07/03	30/06/04	01/07/04	30/06/05
Belford Hospital	not collected	not collected	01/03/04	01/05/06
Monklands Hospital	01/11/03	31/10/04	01/11/04	31/10/05
Hairmyres Hospital	01/11/03	31/10/04	01/11/04	31/10/05
Wishaw General Hospital	01/11/03	31/10/04	01/11/04	31/10/05
Aberdeen Royal Infirmary	01/10/03	30/09/04	01/10/04	30/09/05
Western General Hospital	01/09/03	31/08/04	01/09/04	31/08/05
Royal Infirmary of Edinburgh	01/08/03	31/07/04	01/08/04	31/07/05
St John's Hospital At Howden	01/01/04	31/12/04	01/01/05	31/12/05
Ninewells Hospital	01/06/04	31/12/04	01/01/05	31/12/05
Perth Royal Infirmary	01/01/04	31/12/04	01/01/05	31/12/05
Forth Valley	01/01/04	31/12/04	01/01/05	31/12/05
Dumfries & Galloway Royal Infirmary	01/07/03	30/06/04	01/07/04	30/06/05
Western Isles Hospital	10/10/04	31/07/05	01/08/05	31/03/06
Orkney	01/01/04	31/12/04	01/01/05	31/12/05
Shetland	01/01/04	31/12/04	01/01/05	31/12/05

SSCA Scotland data periods by hospital – Outpatients

	2003/2004		2004/2005	
Hospital	**Start Date**	**End Date**	**Start Date**	**End Date**
Crosshouse Hospital	01/03/04	31/10/04	01/11/04	31/10/05
The Ayr Hospital	01/01/04	31/10/04	01/11/04	31/10/05
Lorn & Islands District Gen Hospital	01/03/04	31/12/04	01/01/05	31/12/05
Inverclyde Royal Hospital	01/09/03	01/09/04	09/01/04	31/08/05
Royal Alexandra Hospital	01/09/03	31/08/04	01/09/04	31/08/05
Victoria Hospital	08/12/03	07/06/04	08/06/04	07/06/05
Queen Margaret Hospital	08/12/03	07/06/04	08/06/04	07/06/05
Raigmore Hospital	not collected	not collected	03/02/05	02/02/06
Hairmyres Hospital	01/11/03	31/10/04	01/11/04	31/10/05
Aberdeen Royal Infirmary	not collected	not collected	01/04/2005	31/03/2006
Western General Hospital	01/09/03	31/08/04	01/09/04	31/08/05
Royal Infirmary of Edinburgh	31/05/03	01/06/04	02/06/04	30/06/05
St John's Hospital At Howden	01/01/04	31/12/04	01/01/05	31/12/05
Perth Royal Infirmary	01/01/04	31/12/04	01/01/05	31/12/05
Stracathro	01/01/04	31/12/04	01/01/05	31/12/05
Dumfries & Galloway Royal Infirmary	01/01/04	31/12/04	01/01/05	31/12/05

Appendix E – Glossary of terms

CHD: Coronary Heart Disease

CHSS: Chest Heart and Stroke Scotland

CRAG: Clinical Resource and Audit Group

CSO: Chief Scientist's Office

CT: Computerised (Axial) Tomography

CVD: cardiovascular disease

GRO: General Registers Office

ISD: Information and Statistics Division, NHS Scotland

LREC: Local Research Ethics Committee

MCN: Managed Clinical Network

MREC: Multi-Centre Research Ethics Committee

MRI: Magnetic Resonance Imaging

NCDDP: National Clinical Dataset Development Programme

NHS QIS: NHS Quality Improvement Scotland

PAS: patient administration systems

RCP(E): Royal College of Physicians-Edinburgh

SCI: Scottish Care Information

SEHD: Scottish Executive Health Department

SIGN: Scottish Intercollegiate Guidelines Network

SMR 01: Scottish Morbidity Record, Type 01

SOP: Standard Operating Procedure

SSCA: Scottish Stroke Care Audit

SSCAS: Scottish Stroke Care Audit System

STAG: Scottish Trauma Audit Group

SU: Stroke Unit

TIA: Transient Ischaemic Attack