Scottish Arthroplasty Project

Annual Report 2006

Contents

Acknowledgements

The Scottish Arthroplasty Steering Committee would like to thank; Mr Colin Howie, for chairing the committee for the past three years.

In addition, the Committee would like to acknowledge the helpful contributions of Miss Jennifer Jerome, Mr David Grant and Mr Peter Hampton who have recently started working as analysts on the project. Thanks also to Stephen Halcrow and Joanne Hattie who produced some of the new analysis.

Key Points

- Death, dislocation and DVT following joint replacement have all reduced, in some cases significantly, over the past 3 years. (Page 30: Consultant Surgeon Data for Complications Following Elective Primary Knee Replacement)

- Despite large numbers of NHS patients being treated in the private sector no outcome data is available. (Page 7: Data from Private Hospitals)

- Surgeons and health boards are now fully engaged in the governance process. There is evidence of individual and group change for the better. (Page 11: Clinical Governance Policy and Results)

- Individual anaesthetic departments are participating in the audit at a hospital level and are included in the report. They have been invited to respond to enquiries about their myocardial infarction, stroke and intestinal bleed rate following joint replacement. (Page 15: Investigation into Anaesthetic Complications)

- Efficiency improvements. Although there has been a 20.5% increase in THR since 1996 there has been a 28% reduction in total bed stays for THR. For TKR there has been a 57.6% increase in numbers and a 10% decrease in total bed days. (Page 38: Average Length of Stay Analysis)

- Data completeness has improved substantially. (Page 6: Data Analysis)

- Analyses on deprivation data do not suggest that there is an “inverse care” effect for arthroplasty - operation rates in the least and most deprived groups being broadly similar. However, our data exclude cases done in the private sector and this picture is likely to change when these are included. (Page 19: Observed and expected number of operations performed by deprivation category)

1. Introduction

For 2006 we have produced an abridged report for paper release, the full report (including detailed named health board data) and all previous reports are available on the SAP website at (www.show.scot.nhs.uk/arthro).

We hope that the public will recognise and support the considerable commitment made by the Scottish orthopaedic community to the governance process resulting in demonstrable improvements. Patients are encouraged to discuss their forthcoming joint replacement and its possible result with their consultant. At that consultation the patient can be assured that the surgeon is aware of his own results and that the hospital results are freely available through this report.

This SAP report, as before, includes some new analysis on arthroplasty; Anaesthetic outcomes, deprivation studies and a report on the governance process. It also includes some analysis on prolapsed intervertebral disc. This may seem idiosyncratic. In previous years colleagues have commented that the report had little for those who did not carry out arthroplasty procedures. We performed basic analysis on disc surgery because it is common and we can compare the results with those operations carried out in Scotland but not by orthopaedic surgeons. We hope that this will be of interest to a wider audience and serve as an example of what is possible with the existing dataset.

There are a number of areas where there has been significant progress, data completeness is much better, the number of arthoplasties continues to rise but the process of care is demonstrably more efficient and the number of revisions remain in check. Surgeons and boards are complying with the governance process. Perhaps most encouraging is that we can now detect an overall improvement in some outcomes (infection, death and dislocation) and note that individuals who had outlying figures have over time come to lie within the accepted limits.

2. Data Analysis

2.1. Data Completeness

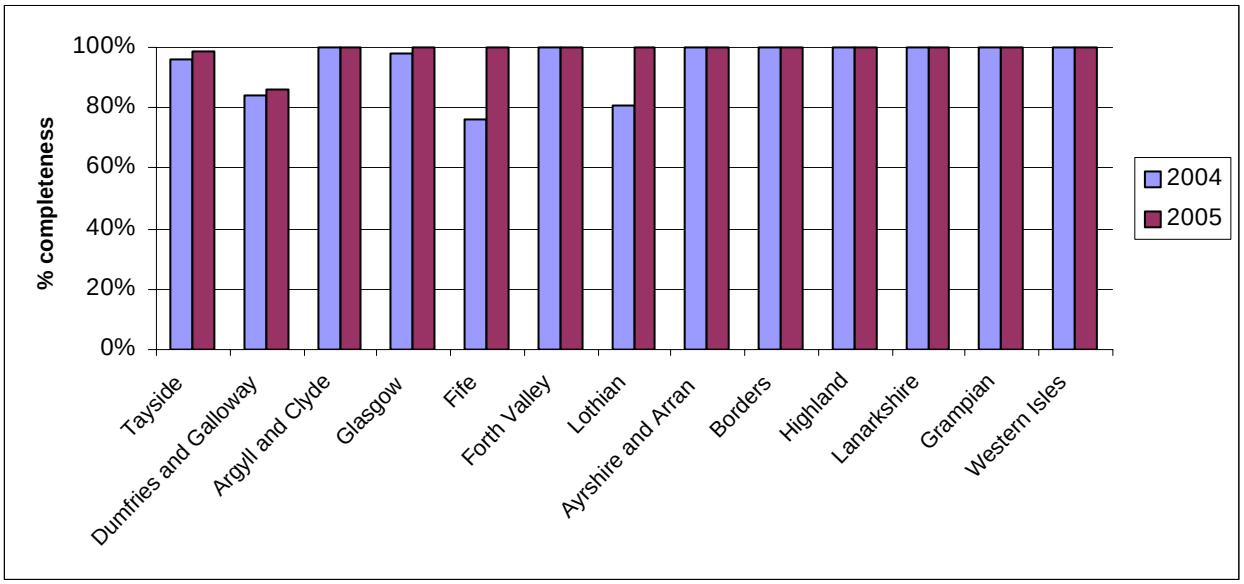
2.1.1. SMR01 Data Completeness

Hospitals send the SMR01 records, used by the Scottish Arthroplasty Project to the Information Services Division (ISD) retrospectively. The national standard states that these records should be sent to ISD within 3 months of a patient's discharge from hospital. In practice, the majority of SMR01 records are submitted within 6 – 9 months of a patient's discharge. Details about how data completeness is determined can be found in section 4.2 of the 2004 annual report.

The latest data in this report are for patients treated in hospital between 1st April 2004 and 31st March 2005. ISD conducts a routine 2% case note review to assess the quality of coding. We are confident that the record sets that are used are sufficiently complete and accurate to make statistically valid conclusions.

Figure 1 illustrates why more up to date orthopaedic data cannot be used. ISD have not received all SMR01 forms for orthopaedic data from April - June 2005 from several NHS Boards therefore the data is not yet viable. ISD conducts a routine 2% case note review to ensure that the quality of coding remains high. We are confident that the record sets that are used are sufficiently complete and accurate to make statistically valid conclusions.

Figure 1 – Data completeness for April to June 2004, based on SMR01 records received by end February 2005 compared to Data completeness for April to June 2005, based on SMR01 records received by end February 2006



2.1.2. Data from Private Hospitals

It is disappointing that we are unable to monitor results in this growing sector. We believe that private patients would want to ensure that their surgeon's performance is monitored in the same rigorous way as the NHS monitors performance. We hope that the private sector will submit data to the Scottish Arthroplasty project in the near future and that private patients will ask their surgeon for his results from the Scottish Arthroplasty Project.

There are an increasing number of patients who have their hip or knee replacement carried out at a private hospital. This is either as a private patient, or as an NHS patient being treated under a waiting list initiative. The NHS Board that contracts out the operations to the private sector is responsible for submitting the SMR01 records of those patients who are treated under the waiting list initiative. These records are not reliably returned at present. ISD and the National Waiting Times Unit at the Scottish Executive have taken up this issue. ISD has reminded NHS Board Chief Executives of the requirement to submit SMR01 and an updated Health Department Letter (HDL) is planned to restate the requirement on NHS Boards to submit these records. The private hospitals will be expected to produce routine counts of NHS patients treated in order to enable the volumes of SMR01 forms submitted to ISD to be monitored.

Ultimately, patient referral communication from NHS to private hospitals is likely to become electronic and provide an opportunity to establish direct submission of SMR data from private hospitals to ISD. The private sector is already involved in thinking about submitting SMR01 records to ISD electronically. As a first step towards this, Murrayfield Hospital in Edinburgh have recently started collecting the Scottish Joint Registry dataset on all hip and knee patients that they operate on, both through the NHS and locally, using an Access database.

Table 1 – Submitted SMR01 Hip and knee arthroplasty procedures where a private facility is the place of treatment. The figures in the brackets represent the number of submissions up to September 2004.

Provider of Care	Hospital of treatment	2002/03			2003/04			2004/05		
		Hip	Knee	Knee Rev	Hip	Knee	Knee Rev	Hip	Knee	Knee Rev
NHS Ayrshire	Carrick Glen Hospital	2	12			2		4	7	
NHS Ayrshire	Ross Hall Hospital	1	2			1		4	14	
NHS Borders	Glasgow Nuffield Hospital							4	2	
NHS Borders	Murrayfield Hospital				6 (6)	4 (4)				
NHS Glasgow	Ross Hall Hospital	13 (13)	14 (14)		22 (16)	23 (15)			5	
NHS Glasgow	Glasgow Nuffield Hospital	4 (4)	1 (1)							
Ross Hall Hospital	Ross Hall Hospital	1 (1)	2 (2)		6 (6)	16 (16)				
Glasgow Nuffield Hospital	Glasgow Nuffield Hospital	13 (13)	8 (8)	2 (2)						
NHS Grampian	Fernbrae Hospital							1	1	
NHS Grampian	Albyn Hospital				10 (10)	15 (15)		8 (2)	8 (2)	
TOTAL		**34 (31)**	**39 (25)**	**2 (2)**	**44 (38)**	**61 (50)**		**31 (2)**	**43 (2)**	

Note: ISD are aware that this data used to populate this table is largely incomplete

2.2. National Trends in Numbers of Operations

Figure 2 to 5 represent the numbers of combined elective and emergency joint replacement operations (both primary and revision for hip and knee) recorded as performed in NHS Scotland in each of the last 14 years (1992 to 2005). The vast majority of operations were performed as an elective procedure. (Around 94% of primary hip replacements, 99% of primary knee replacements, 78% of revision hip replacements and 90% of revision knee replacements). All numbers are displayed by year ending 31st March.

The number of primary hip and knee replacements has been increasing steadily since 1992 with a marked rise from 2002 onwards. In 2004/2005 there were 4,823 primary hip replacements and 4,414 primary knee replacements. We expect knee replacement to outstrip hip replacement in the near future as happened in Australia in 2002-3.

Figure 2 – Primary Hip Replacements by year ending March

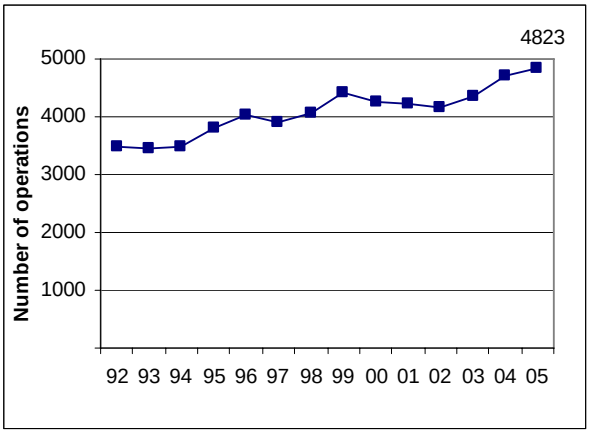


Figure 3 – Primary Knee Replacements by year ending March

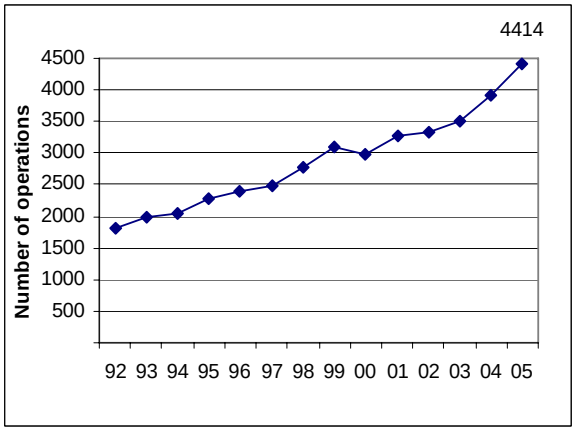


Figure 4 – Revision Hip Replacements by year ending March

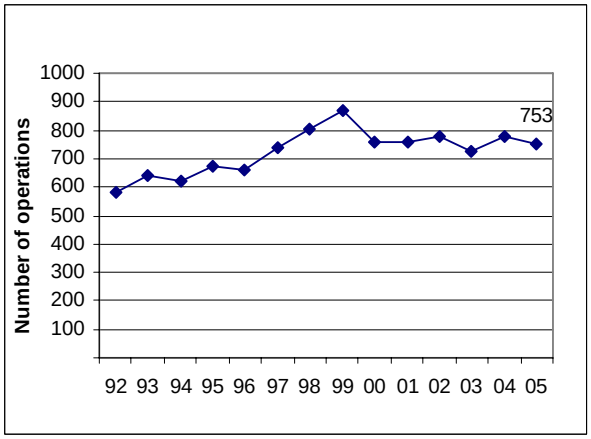
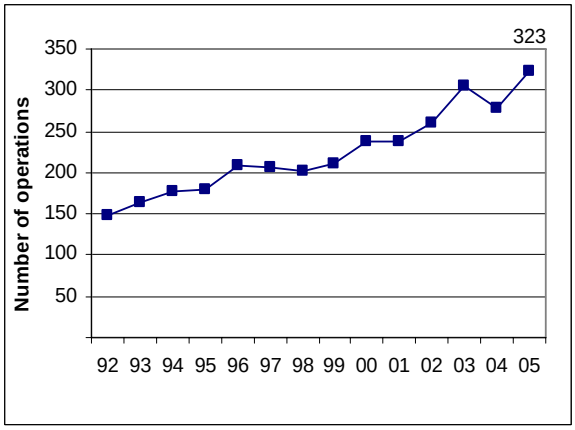


Figure 5 – Revision Knee Replacements by year ending March



Many more joint replacements have been performed in the private sector (paid for by the NHS) but we have no figures for these.

Further arthroplasty activity trend charts can be found in Appendix 1 (shoulders and elbows) and Appendix 2 (fingers, wrists, thumbs, toes and ankles) at (www.show.scot.nhs.uk/arthro).

Table 2 shows the ratios of primary operations to revision operations for hip and knee in Scotland and compared to other countries that perform arthroplasty audits. The figures are based on crude rates and show the revision rate for hips to be highest in Australia (16.8%) and lowest in Sweden (12.2%) with 13.5% of primary hip operations requiring some form of revision in Scotland. The revision rates in Sweden take into account the number of revisions they have preformed due to an infected hip or knee prosthesis.

Knee revision ratios are lowest in Sweden and Scotland (6.6% and 6.8% respectively) and highest in Australia (10%). The lower rate of revision for knee replacements compared with hip replacements reflects the relatively small number of knee replacements carried out 10-20 years ago.

Table 2 – International Comparison of primary to revision (for all causes) operation ratios

Hips	Scotland April 04 - March 05	Australia[1] July 03 - Jun 04	Norway[2] Jan 04 - Dec 04	Sweden[3] Jan 03 - Dec 03
Primary Operations	4823	19380	6144	13366
Revisions	753	3907	917	1726
Primary + Revision	5576	23287	7061	14092
Crude Revision Rate %	**13.5**	**16.8**	**13.0**	**12.2**

Knees	Scotland April 04 - March 05	Australia[1] July 03 - Jun 04	Norway[2] Jan 04 - Dec 04	Sweden[4] Jan 03 - Dec 03
Primary Operation	4414	23463	2874	8327
Revision	323	2612	316	585
Primary + Revision	4737	26075	3190	8912
Crude Revision Rate %	**6.8**	**10.0**	**9.9**	**6.6**

Caveat: The Swedish arthroplasty Audit states that a significant number of revisions had been lost. In 2003, the revisions rate was 13%.

1 Source: AOA National Joint Replacement Registry

2 Norwegian Arthroplasty Register

3 Swedish National Hip Arthroplasty Register

4 Swedish Knee Arthroplasty Register

2.3. Clinical Governance Policy and Results

Clinical Governance: "A framework through which NHS organisations are accountable for continually improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish"
Scally G. Donaldson L.J. BMJ 1998:317 61-65

Since its inception, the policy of the Scottish Arthroplasty Project has been to provide high quality data on activity and complications. which can be used at a local level to promote change and assist consultant appraisal. Simple monitoring of activity and quality may influence clinical practice but can be insufficient to create significant change. With the support of the SCOT committee a feedback and review system was introduced at board and consultant level to look at quality issues, which appeared to vary from national standards.

Volume and type of activity data are supplemented by rates for complications including death, revision, venous thrombo-embolism, infection and dislocation. Each consultant and health board is sent their own activity and complication data in context with the national average. Statistical limits on performance are set and any outlying normal variation subject to a confidential review. The information is provided as funnel plots with a national average and limits of two standard deviations. It is important to emphasise that the techniques to identify outlying results are statistical and despite some standardisation do not necessarily imply poor performance (Harley M et al, 2005).

Every orthopaedic consultant and health board are encouraged to review their own figures, as part of a robust local clinical governance system, even if they are not identified as outliers. Deaths are not reviewed as the Scottish Audit of Surgical Mortality appropriately deals them with. (www.sasm.org.uk)

The consultant and health board outlier process has evolved over the last four years and consists of identification of outliers, a request for a response based on local investigation and a review of that response.

2.3.1 Consultant Outliers

Every consultant outlier is requested to investigate the accuracy of the data and the clinical features of each case. They are asked for general comments and an action plan if any issues are found. The introduction of a new technique, a new implant or particular case mix issues may be identified. It is essential that the completed response be co-signed by a consultant colleague as verification. The response is then assessed by the committee anonymously and scored as to its relevance. If the response is unsatisfactory then a resubmission addressing any discrepancy is requested. The process is anonymous with no members of the committee knowing the source of any response or recipient of the review.

Table 3 – Summary of Consultant Outliers

Report Year	Outlying Points	Outlying Consultants	Retired or No longer working in NHS Scotland	Also Outliers in previous two years	Also Outliers in previous year	New Outliers
2003	33	32	15			15
2004	33	32	13		4	10
2005	26	24	7	4	11	7
2006	28	28	8	11	12	16

Prior to 2005 there were consultants who were outlying for more than one complication. This resulted in a discrepancy between the number of outlying points and the number of outlying consultants. In 2006 there were no such consultants.

For statistical accuracy, the figures are derived over five years. It is therefore inevitable that some outliers continue to be identified until their five-year average returns to within normal variation. Sixteen new outliers, currently in practice in NHS Scotland will be invited to respond in the coming year. They will be notified in June 2006 and will be expected to respond by September 2006.

Table 4 – Summary of Consultant Outlier Responses 2003-2004

Report Year	New Consultant Outliers	Outlying Points	Response	Better than Satisfactory	Less than Satisfactory
2003	15	16	15	14	1
2004	10	11	10	7	3

During the first two years consultant the surgical members of the committee and the data staff reviewed outlier responses. They were simply graded as satisfactory or unsatisfactory. Unsatisfactory responders were sent another letter and asked to comment further. All responses were ultimately satisfactory. The experience gained indicated that more formal assessment criteria of the response and classification of that response were needed. This was introduced in 2005 and facilitated involving the whole committee, including the lay members, in the governance process.

The new format for assessment and scoring of the outlying consultant and health board responses is as follows:

Assessment of Response by Outlying Consultants

- Promptness of Response
- Presence of
    a) Assessment of Data quality
    b) Informed criticism of results through local audit
    c) Appropriate action plan to address issues arising from analysis.
    d) Document co-signed by consultant colleague

Scoring of Response by Outlying Consultants

- Exemplary Constructive Response with evidence of progress
- Excellent Constructive Response
- Satisfactory Minimum response
- Less than satisfactory Unacceptable

It is envisaged that the new assessment and scoring system will prove more flexible and constructive for consultant appraisal.

Table 5 – Summary of outlier responses for outliers for 2005

Outlier type	Consultants	Outlying points	Response	Exemplary	Excellent	Satisfactory	Less than satisfactory	Late response, awaiting review	Referred to Chief Executive
New Consultant Outliers	7	8*	8	3	1	2	0	0	0

* data from one consultant (on two outlying points) is being investigated at ISD as some cases are missing from ISD records.

In 2005 there were seven new consultant outliers. The responses were graded as exemplary or excellent in the majority, with two being satisfactory and none less than satisfactory. There was complete compliance with the process and the improved grades over previous years suggested greater acceptance and understanding of the aims of the project. In addition eleven consultants remained outliers during 04/05 and four over 03/04/05. In most cases this was related to previous

performance with satisfactory responses from previous years. For completeness they were also invited to review their cases and previous responses. Future analysis will look at trends amongst outliers to identify improvements over time with a shift towards normal variation.

2.3.2 Board Outliers

A similar process occurs with NHS Board data but the information is sent to the Chief Executive. Following an appropriate investigation the Action Plan is co-signed by the Chief Executive and the appropriate Clinical Director (further information in the 2004 Annual Report – section 6.2.2).

Table 6 – Summary of NHS Board Outliers

Report Year	Outlying Points	Outlying Boards	Also an outlier in previous 2 years	Also Outliers in previous year	New Board Outliers
2003	7	4			4
2004	6	5		3	2
2005	5	4	3	3	1
2006	4	4	2	2	2

The initial response to the 2003 data was disappointing; with only one board responding within the time frame, and one has not responded to date. In keeping with the previous structure created to deal with non-compliance the Chief Executive was informed and action taken. Two of the three responses were regarded as less than satisfactory. In 2004, both boards responded and they were classified as satisfactory. In 2005 all boards responded satisfactorily.

3 Investigation into Anaesthetic Complications

The Royal College of Anaesthetists Board in Scotland has agreed to participate in the Scottish Arthroplasty Project. A multidisciplinary approach to the peri-operative care of patients undergoing joint replacement is instrumental to their optimal management. Peri-operative complications are usually multi-factorial but there is no doubt that pre operative assessment of risk and anaesthesia are a key contribution to outcome.

The anaesthetic assessment of patients undergoing joint replacement may be very difficult. The nature of their orthopaedic problems may render accurate assessment of their cardio-respiratory function impossible. This makes the pre-operative discussion of “risk” for the individual patient difficult and confusing. It is in the area of risk assessment and peri-operative cardiovascular health that the influence of the anaesthetist is greatest. At present there are no reliable figures for complication rates relating to cardiovascular events (one of the commonest life threatening peri-operative problems) following orthopaedic surgery for Scotland as a whole or for individual units. The anaesthetic complication rates calculated in this section can be used to facilitate pre-operative discussion of overall risks with patients.

The analysis of complication rates in this report and previous reports has mainly concentrated on complications arising from the actual type of surgery undertaken (dislocation, infection or revision). This year complications which may be more closely associated with pre-operative assessment or peri-operative care have been investigated. We have concentrated on the following conditions following hip or knee replacement

- acute myocardial infarction (AMI) within 30 days following surgery;
- stroke within 30 days following surgery; and
- gastro-intestinal bleeds within 30 days following surgery.

These complications were chosen because they reflect the additional complications which cause most concern to the patients (AMI and stroke) or which may result from analgesic use or anticoagulation (gastro-intestinal haemorrhage). The control charts in Chapter 5 showing standardised rates for mortality and DVT/PE are also relevant to the investigations of anaesthetic complications. Examining other complications (e.g. renal failure) or relating the type of anaesthesia provided to outcome may also be relevant and will be investigated in later years.

For each of these outcomes, control charts are presented for both elective primary hip and elective primary knee replacements. Each cross in Figures 6 to 11 shows the actual number of complications for an NHS Board in Scotland. The upper control limit is taken to be 3 standard deviations above the expected complication rate. Previously we have produced Shewhart charts, as we did originally for the other complications following joint replacement, because they have given us a clear indication of general levels of problems. The use of Shewhart charts may be especially useful in the discussion of risks pre-operatively with patients. Further work has now been done to adjust for case mix and the standardised data are now presented as complication rates, not as actual numbers of complications.

This year, all the data have been standardised for;

- age;
- sex;
- admission from home or other place of residence (e.g. nursing home);
- rheumatoid arthritis; and
- deprivation.

A health board specific report was sent out to the head of anaesthetics of every hospital performing joint replacements in January 2006. The report contained information on their health board's observed and expected rates for AMI following hip replacement along with a run chart for the same. Reponses were invited from anaesthetists to determine if they found the data useful. At the time of print, no responses have so far been received.

Figures 6 to 11 show the results of the analysis. With the exception of Ayrshire and Arran's GI bleed rate after knee replacement, none of the health boards complication rates are out with the upper control limit. The reported rates are reassuring and within published international complication rates.

C: Argyll and Clyde	NG: North Glasgow	F: Fife
A: Ayrshire and Arran	SG: South Glasgow	H: Highland
B: Borders	L: Lanarkshire	N: Grampian
Y: Dumfries and Galloway	V: Forth Valley	S: Lothian
W: Western Isles	T: Tayside	
D: Golden Jubilee National Hospital		

Figure 6 – Observed and Expected Standardised Rate for AMI within 30 days of a hip operation

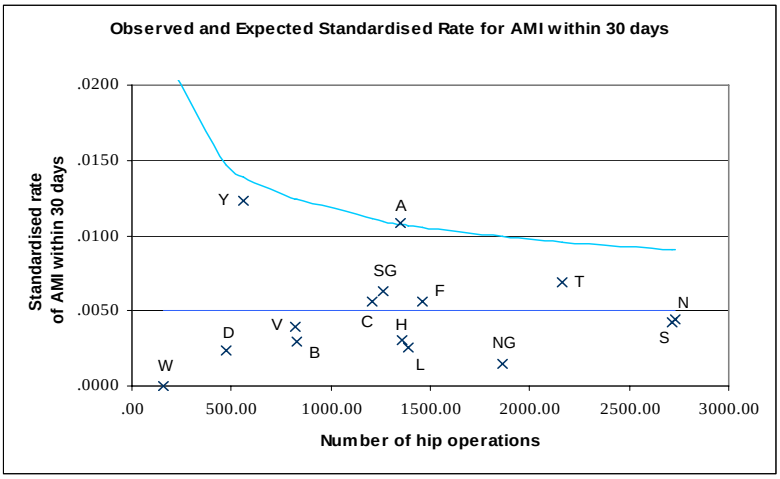


Figure 7 – Observed and Expected Standardised Rate for AMI within 30 days of a knee operation

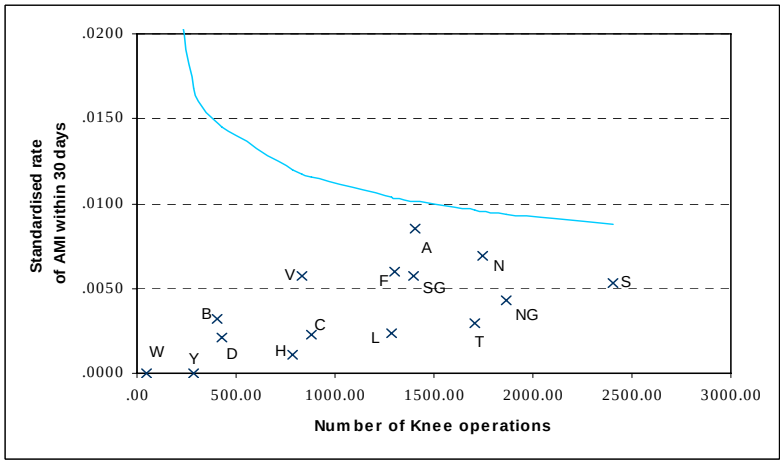


Figure 8 – Observed and Expected Standardised Rate for GI Bleed within 30 days of a hip operation

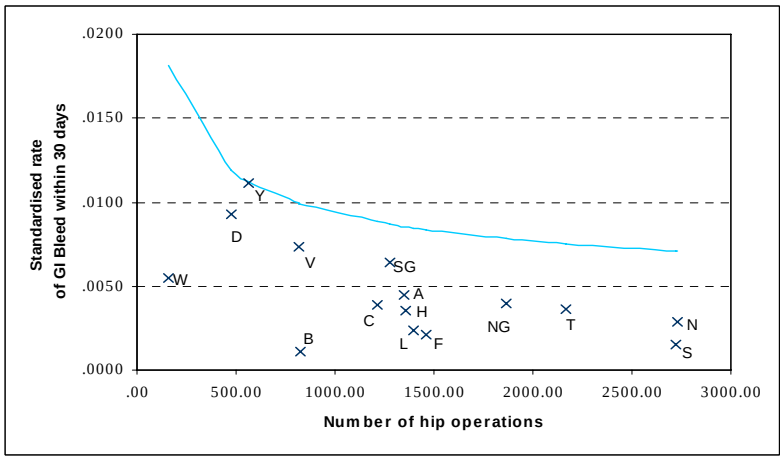


Figure 9 – Observed and Expected Standardised Rate for GI Bleed within 30 days of a knee operation

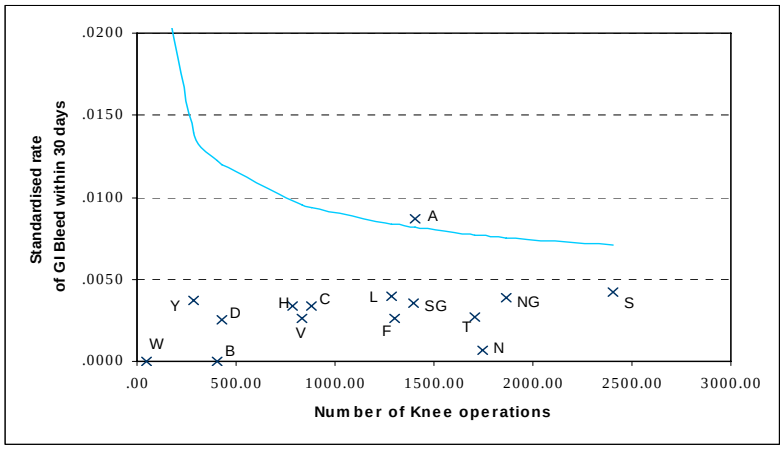


Figure 10 – Observed and Expected Standardised Rate for Stroke within 30 days of a hip operation

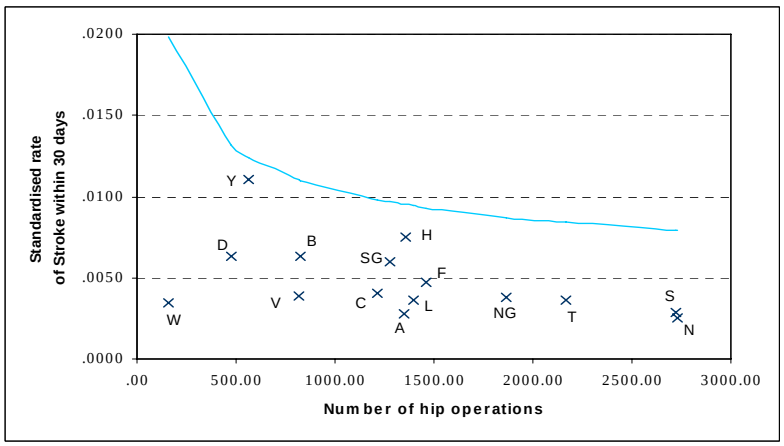
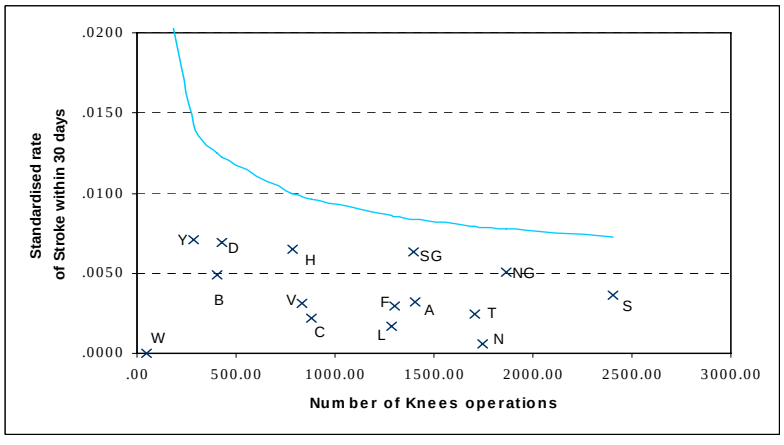


Figure 11 – Observed and Expected Standardised Rate for Stroke within 30 days of a knee operation



4 Observed and expected number of operations performed by deprivation category

Deprivation and health

There are unacceptable differences in healthy life expectancy in Scotland (Delivering for Health, Scottish Executive, Edinburgh 2005). It is therefore important to try to ensure that access to health care is equitable across all socioeconomic groups. A common finding in health care is that more affluent sections of society have better access to health care – often when their need appears to be lower. This is described in the 'Inverse Care Law' by Tudor Hart in 1971.

Indicators of socioeconomic deprivation derived from census data and linked to health data by postcode are used to monitor this. The indicator used in the following analysis is the Scottish Index of Multiple Deprivation (SIMD). It has six domains (income, employment, education, housing, health, and geographical access) at datazone level, which have been combined into an overall index. Full information on the SIMD 2004 can be found in the SCOTTISH INDEX OF MULTIPLE DEPRIVATION 2004 SUMMARY TECHNICAL REPORT http://www.scotland.gov.uk/library5/society/siomd-00.asp

Figure 12 shows the rate of operations per 100,000 population in Scotland by deprivation category. The rate of operations is highest in deprivation category three and lower in the most deprived and least deprived categories. The pattern is strikingly not one of operation rates inversely associated with socio-economic status. (The unknown here is the relative need i.e. do people in lower socio-economic groups have a higher prevalence of joint disease amenable to operation (we know that those in heavy manual occupations , farmers, have a higher incidence of hip OA). Those in the higher socio-economic groups may undergo surgery in the private sector and are not recorded here.) One possible confounding factor could have been age at operation e.g. different life expectancy or health status at the same age. However, overall median age for primary hip replacements in Scotland is 73 and this varies little across the deprivation categories. (Table 7)

We have used the Scottish operation rates by deprivation category and applied it to the NHS Board populations to give an expected number of operations by deprivation category in each health board (further adjusted by age and sex). The expected number of operations is then compared to the observed number for each health board and the chi-squared test of association is applied to these figures to determine any statistical significance in the distribution of observed to expected.

It should be noted that we do not have information on many of the operations carried out in a private hospital. As many of the private operation will be on members of deprivation categories 1

and 2 this may lead to an underestimation of the amount of hip operations performed on the less deprived.

Figure 12 – Distribution of Primary hip replacements by deprivation category in Scotland.

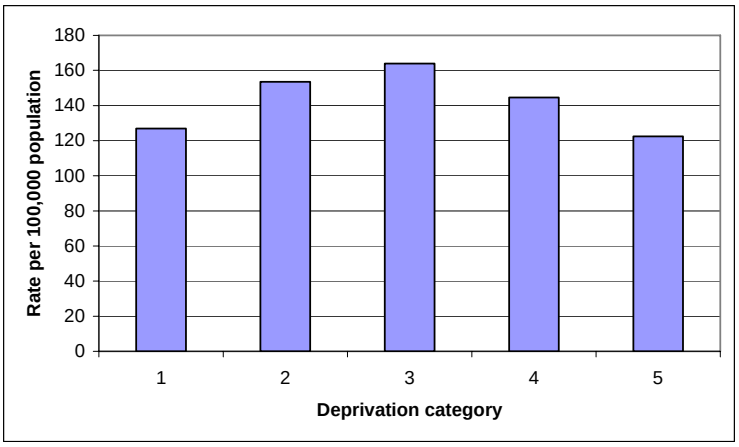


Table 7 – Analysis of patient's age for primary hip replacement in Scotland.

SIMD quintile for Scotland	Total number of patients	Median	Percentile 25	Percentile 75	Mean
1	2493	74	65	82	73.0
2	3030	73	65	81	72.6
3	3241	73	65	81	72.5
4	2874	73	65	81	72.1
5	2471	72	64	80	71.1

Figure 13 and 14 show results for Health Board 1. This Health Board has fewer residents in deprivation categories 4 and 5 therefore the expected number of operations in those categories is low. The observed number of operations in deprivation category 4 is lower than expected. A chi-squared test for distribution shows that the difference is not significant ($p=0.38$). Figure 14 shows the standardised incidence ratios for these figures. The SIR is calculated by comparing the observed and expected rates and is equal to 100 when no differences are found. The upper and lower confidence intervals show whether the SIR is significant (a confidence interval that does not encompass 100 is deemed to be significant). The SIR is less than 100 for deprivation category 4 but does not reach a statistically significant level. All individual named health board data is available in the web report.

Figure 13 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Health Board 1

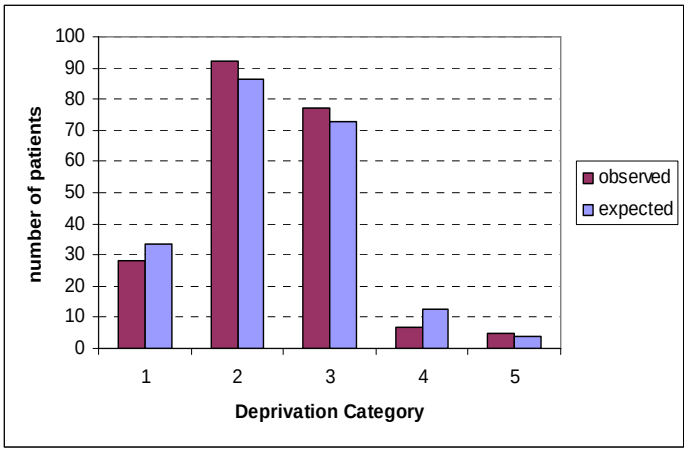
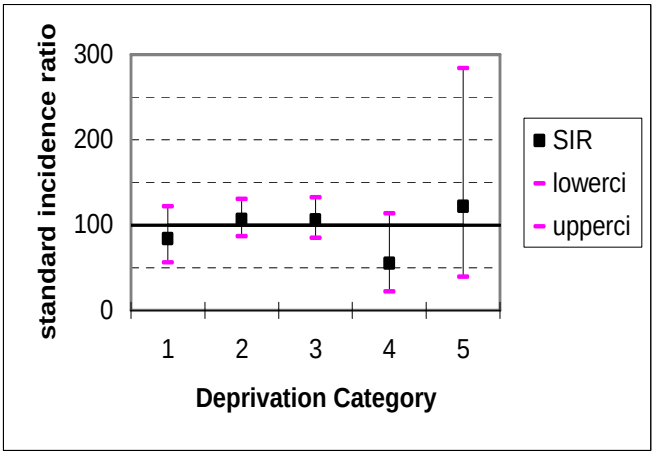


Figure – 14 Standardised Incidence Ratio's by Deprivation Category – Health Board 1



The results for all health boards are shown in Appendix 6. The data presented are adjusted for age and sex. Additional adjustment e.g. for prevalence of rheumatoid or osteoarthritis might give additional information.

5. Complication Rates For Hip and Knee Replacements

For the fourth year, complication data are presented for four different outcomes following elective primary hip or knee replacement:

- dislocation of the joint within 365 days following surgery (for hips only);
- infection (both superficial and deep) of the joint within 365 days following surgery;
- death within 90 days following surgery; and
- deep vein thrombosis/pulmonary embolism (DVT/PE) within 90 days following surgery.

The diagnostic code used to identify an infected prosthesis does not differentiate between deep and superficial infection. This can often be difficult to determine clinically. The International Classification of Diseases (ICD10) codes used to code medical records do not distinguish the severity of an infection.

In previous years, these data have been presented using control charts (see section 5.1.3. 2004 annual report) which displayed the complication data simply by plotting the number of complications against the number of procedures performed. It was decided to develop this analysis by standardising the data for case mix, using all the possible variables available on the national dataset. This method was investigated last year and an example presented in section 6.3 of the 2004 annual report. This year, all the data have been standardised for:

- age;
- sex;
- admission from home or other place of residence (e.g. nursing home);
- rheumatoid arthritis; and
- deprivation.

The standardised data are now presented as complication rates, not as actual numbers of complications. This results in control charts that have a funnel shape to them (funnel plots).

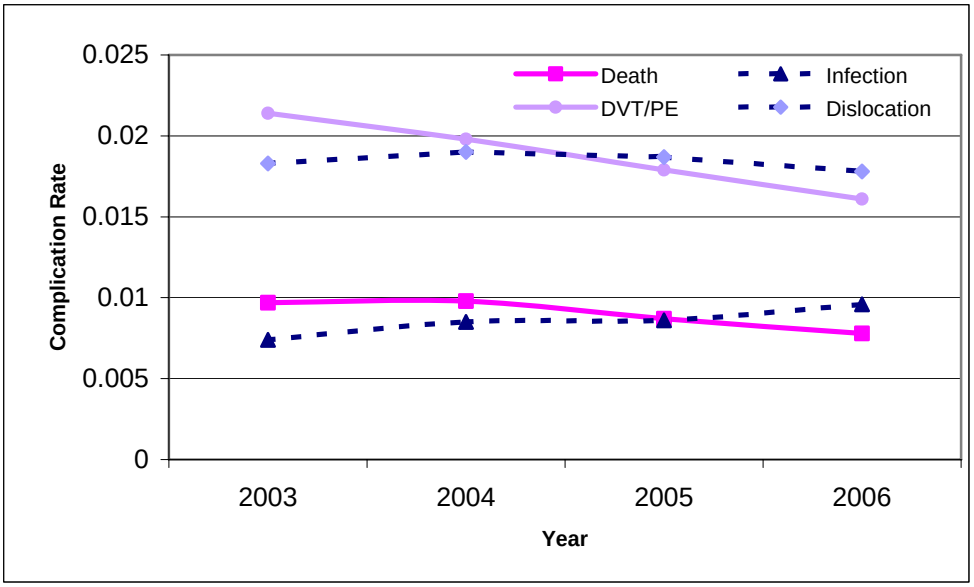
This year, those consultants and NHS Boards that lie outside the upper control limit for the first time (three standard deviations above the expected complication rate) and those who have been outlying for 3 years in a row will be invited to participate in a review of the cases making up this year's outlying number. The purpose of this is to review these figures under the umbrella of clinical governance, with the emphasis on quality improvement and not on attributing blame. Indeed, although we appear to analyse to a surgeon level, the data represents the whole process of care not just the actions of one individual. In many cases, the cause may be in the accuracy of the data, for example, coding problems, but it is still important to investigate this.

5.1. NHS Board Data for Complications Following Elective Primary Hip Replacement

Figure 15 shows the national complication rates for NHS Boards from 2003 to 2006 for deaths, dislocations, infections and DVT/PE. With the exception of infection, figures have decreased for all complications.

Figure 16 to 19 represent the complication rates for patients following elective hip replacement between April 1998 and March 2004. Each cross represents the complication rate for an NHS Board in Scotland (for the label key and explanation of features see page 24). Those Boards that are outlying for the first time and those outlying for a third year in a row will be contacted to explore the reasons for these complication rates. Due to the historical nature of the data and the fact that the data is aggregated over 5 years, it will take some time to show change in board complication rates. Because of this, boards that are outlying for a second year will not be asked to reinvestigate the data, but will be monitored over the forthcoming years.

Figure 15 – National rates for complications following elective primary hip replacements from 2003 to 2006



NHS Board Data for Complications Following Elective Primary Hip Replacement (April 1999 – March 2004)

NHS Boards that were outlying both last year and this year have been marked with a circle and will not be asked to repeat the governance process. Also, the NHS Boards that were outlying last year, but not this year, have been marked with a square and the NHS Boards that have been outling for three years have been marked with a diamond.

Figure 16 – Observed and expected standardised rates of deaths within 90 days

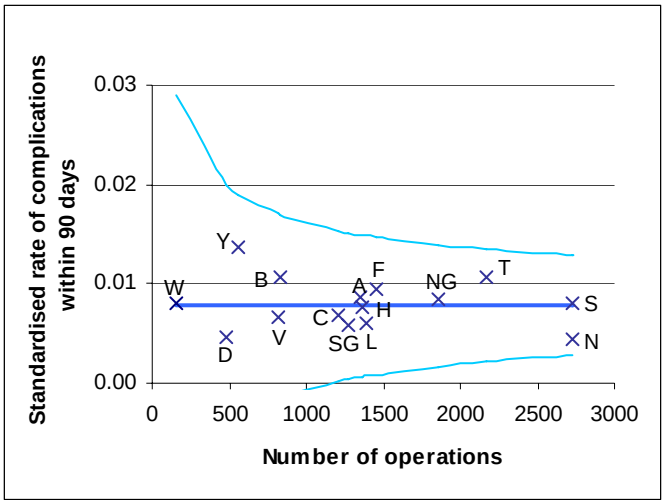


Figure 17 – Observed and expected standardised rates of hip dislocations within 365 days

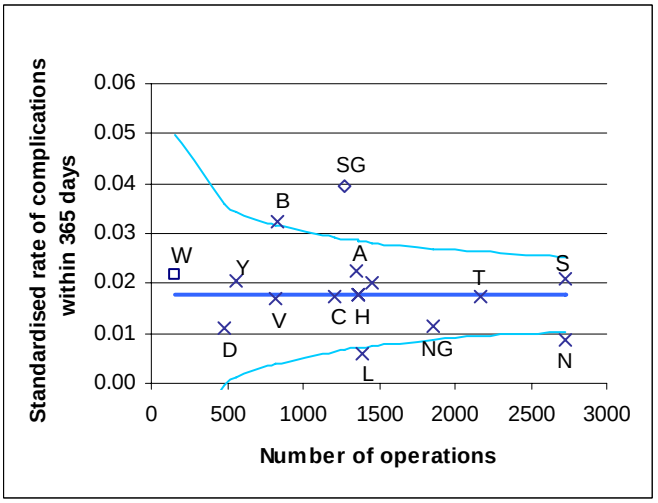


Figure 18 – Observed and expected standardised rates of joint infections within 365 days

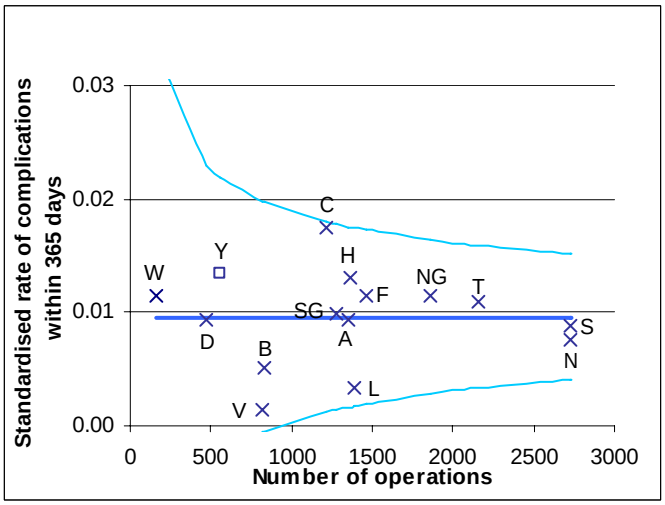
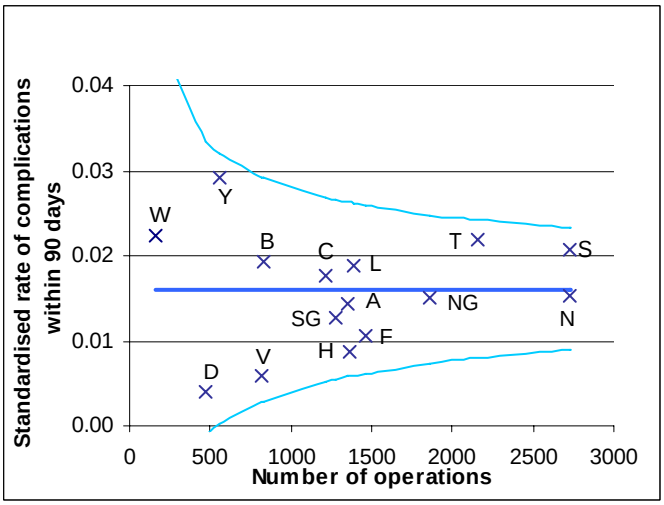


Figure 19 – Observed and expected standardised rates of DVT/PE within 90 days



Key to NHS Board Ciphers

A	Ayrshire & Arran	L	Lanarkshire
B	Borders	N	Grampian
C	Argyll & Clyde	S	Lothian
D	Golden Jubilee	T	Tayside
F	Fife	V	Forth Valley
NG	North Glasgow	W	Western Isles
SG	South Glasgow	Y	Dumfries & Galloway
H	Highland		

Orkney and Shetland are not included as their patients undergo elective arthroplasty surgery in Grampian (Aberdeen) and are included in the Grampian data.

Key to the Features of the Control Charts – this applies to all Funnel Plots in this report

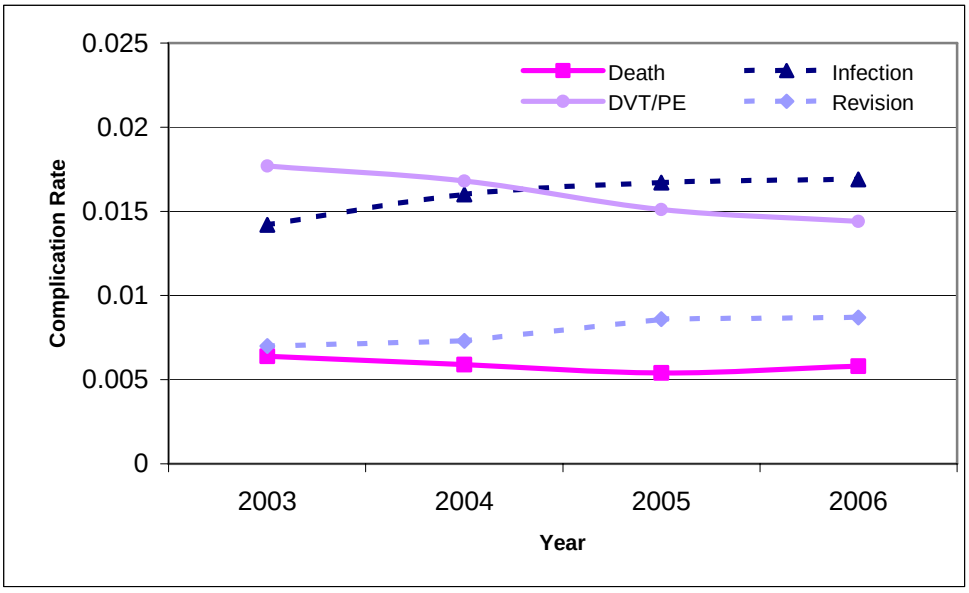
———	Upper and Lower Control Limits
———	Scottish Mean
X	NHS Board or Consultant
□	NHS Board or Consultant who were outlying last year, but not this year
⊗	NHS Board or Consultant outlying for a second year in a row
◊	NHS Board or Consultant outlying for a third year in a row

5.2. NHS Board Data for Complications Following Elective Primary Knee Replacement

Figure 20 compares the national complication rates for NHS Boards from 2003 to 2006 for deaths, knee revisions, infections and DVT/PE. Complication rates for DVT/PE and death have fallen since 2003 however rates have risen for infection and revision.

Figure 21 to 24 represent the complication rates for patients following elective knee replacement between April 1999 and March 2004. Each cross represents the complication rate for an NHS Board in Scotland (for the label key and explanation of features see page 24). Those Boards that are outlying for the first time and those outlying for a third year in a row will be contacted to explore the reasons for these complication rates. Those boards that are outlying for a second year will not be asked to reinvestigate the data, but will be monitored over the forthcoming years. This is due to the historical nature of the data and the fact that it is 5 years aggregated data which would take some time to show change in complication rates.

Figure 20 – National rates for complications following elective primary knee replacements from 2003 to 2006



NHS Board Data for Complications Following Elective Primary Knee Replacement (April 1999 – March 2004)

NHS Boards that were outlying both last year and this year have been marked with a circle and will not be asked to repeat the governance process. Also, the NHS Boards that were outlying last year, but not this year, have been marked with a square and the NHS Boards that have been outling for three years have been marked with a diamond.

Figure 21 – Observed and expected standardised rates of deaths within 90 days

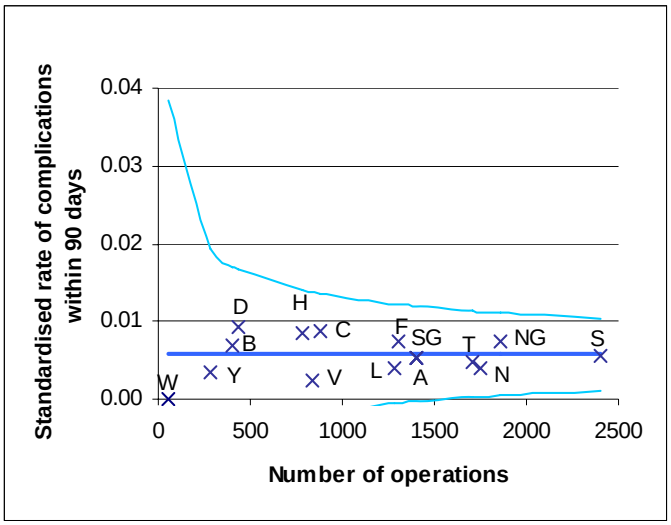


Figure 22 – Observed and expected standardised rates of knee revisions within 365 days

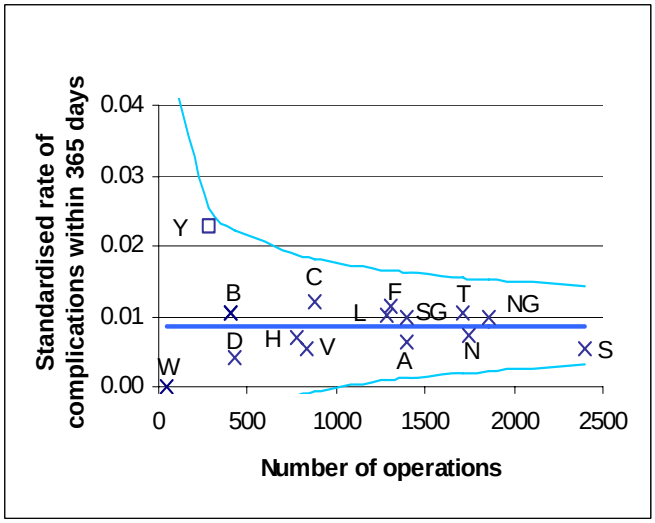


Figure 23 – Observed and expected standardised rates of joint infections within 365 days

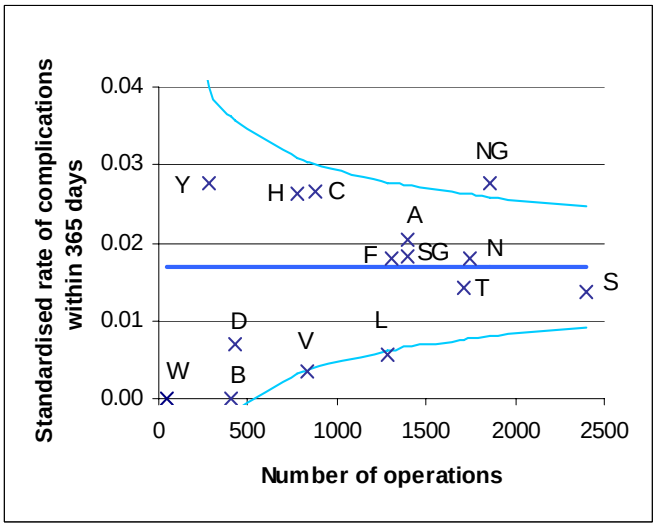
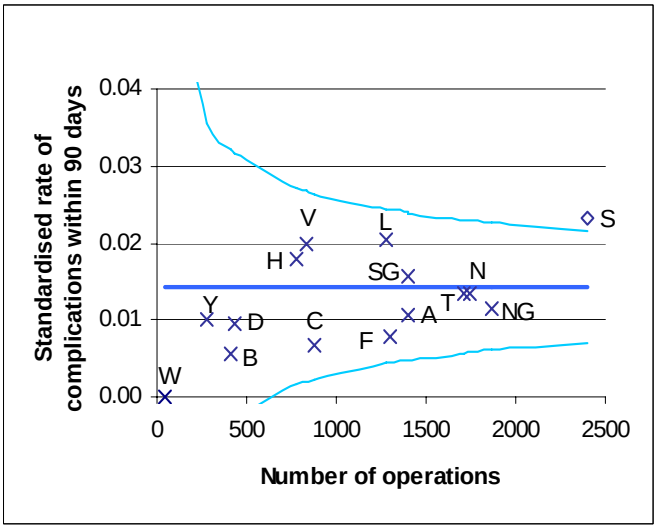


Figure 24 – Observed and expected standardised rates of DVT/PE within 90 days



5.3. Consultant Surgeon Data for Complications Following Elective Primary Hip Replacement

Figures 25 to 28 represent the complication rates for patients following elective hip replacement between April 1999 and March 2004. Each cross represents the complication rate for a consultant in Scotland. For a key to the features of the charts please see page 24. Those consultants who are outlying for the first time and those outlying for a third year in a row will be contacted to explore the reasons for these complication rates. Those consultants who are outlying for a second year in a row will not be asked to reinvestigate the data, but will be monitored over the forthcoming years. This is due to the historical nature of the data and the fact that it is 5 years aggregated data, which would take some time to show change in complication rates.

Because the charts show standardised rates of complications, those surgeons with low numbers of index procedures may have only one complication but this causes a high rate. To account for this the charts show control limits within which variation is likely to be statistical due to low numbers rather than a problem with care. All surgeons (and hospitals), but particularly those with low numbers and high complication rates, should pay particular attention to each individual case.

Consultant Surgeon Data for Complications Following Elective Primary Hip Replacement (April 1999 – March 2004)

Consultants who were outlying both last year and this year have been marked with a circle and will not be asked to repeat the governance process. Also, the Consultants who were outlying last year, but not this year, have been marked with a square and Consultants who have been outling for three years have been marked with a diamond.

Figure 25 – Observed and expected standardised rates of deaths within 90 days

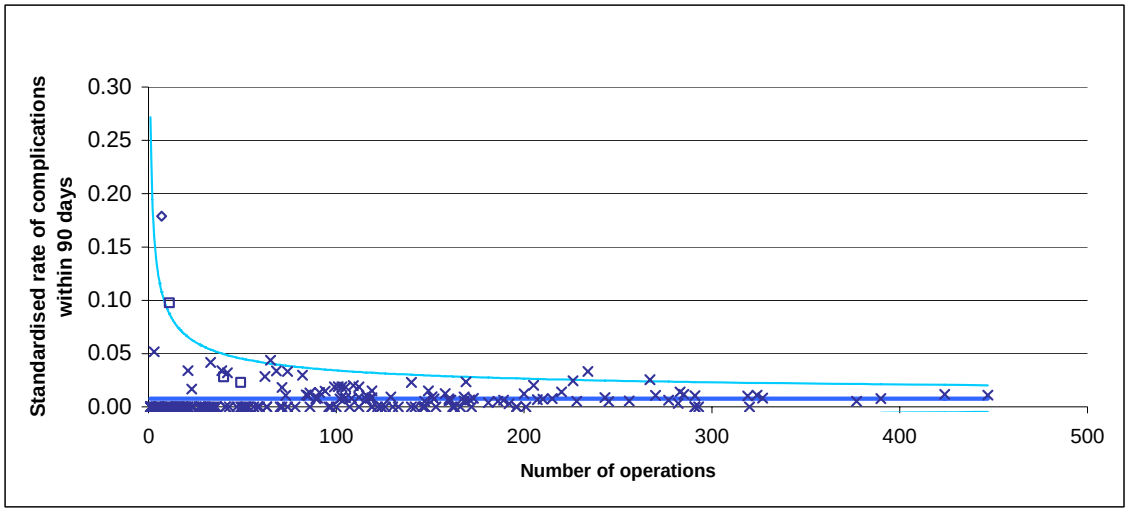


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Figure 26 – Observed and expected standardised rates of hip dislocations within 365 days

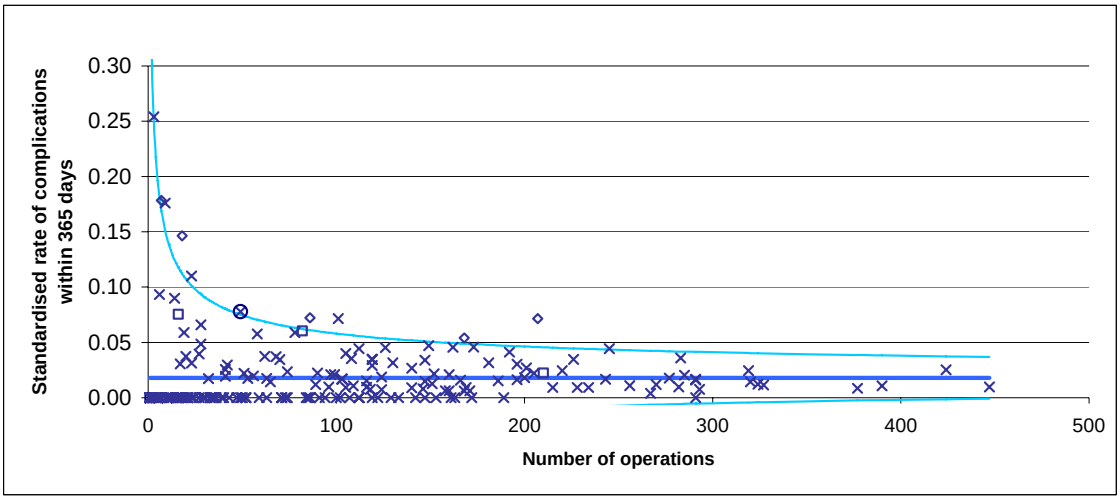


Figure 27 – Observed and expected standardised rates of joint infections within 365 days

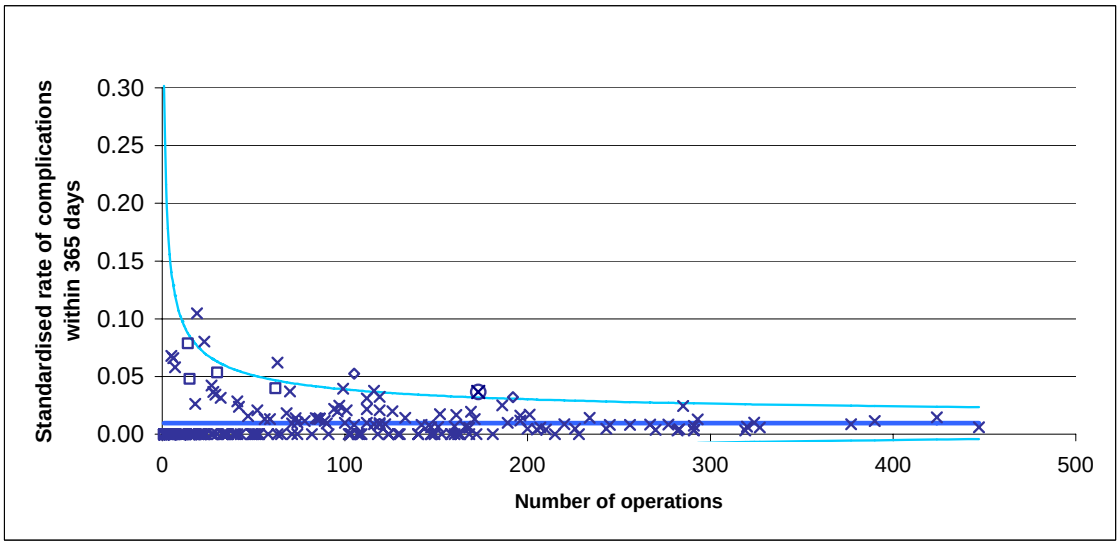
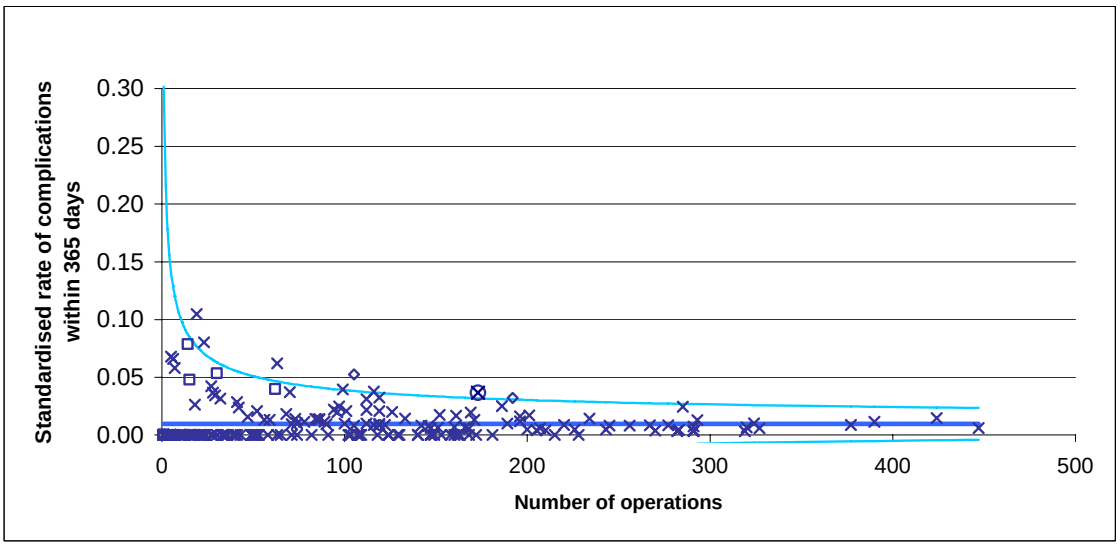


Figure 28 – Observed and expected standardised rates for DVT/PE within 90 days



5.4. Consultant Surgeon Data for Complications Following Elective Primary Knee Replacement

Figures 29 to 31 represent the complication rates for patients following elective knee replacement between April 1999 and March 2004. Each cross represents the complication rate for a consultant in Scotland. For a key to the features of the charts please see page 24. Those consultants who are outlying for the first time and those outlying for a third year in a row will be contacted to explore the reasons for these complication rates. Those consultants who are outlying for a second year in a row will not be asked to investigate the data, but will be monitored over the forthcoming years. This is due to the historical nature of the data and the fact that it is 5 years aggregated data which would take some time to show change in complication rates.

Consultant Surgeon Data for Complications Following Elective Primary Knee Replacement (April 1998 – March 2003)

Consultants who were outlying both last year and this year have been marked with a circle and will not be asked to repeat the governance process. Also, the Consultants who were outlying last year, but not this year, have been marked with a square and Consultants who have been outlying for three years have been marked with a diamond.

Figure 29 – Observed and expected standardised rates of deaths within 90 days

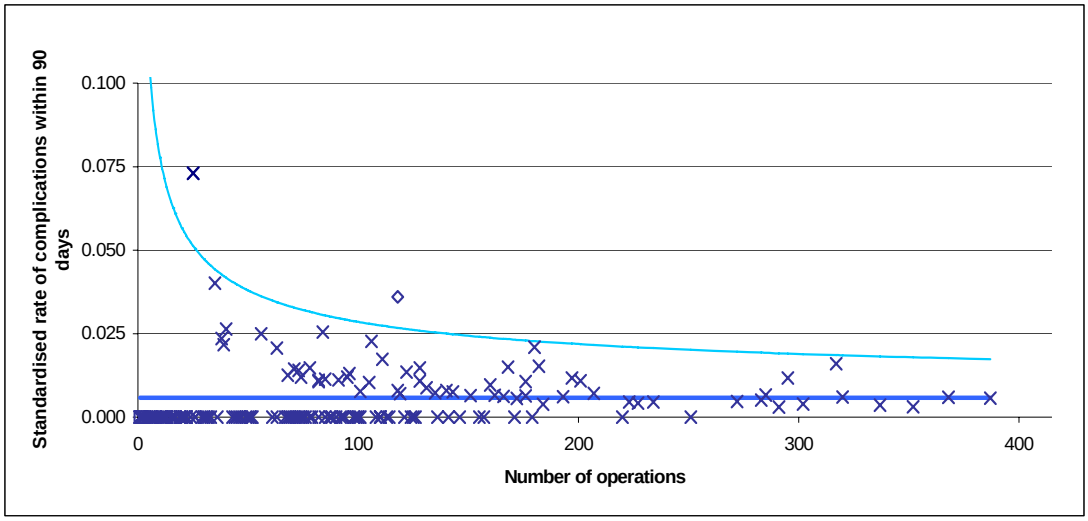


Figure 30 – Observed and expected standardised rates of joint infections within 365 days

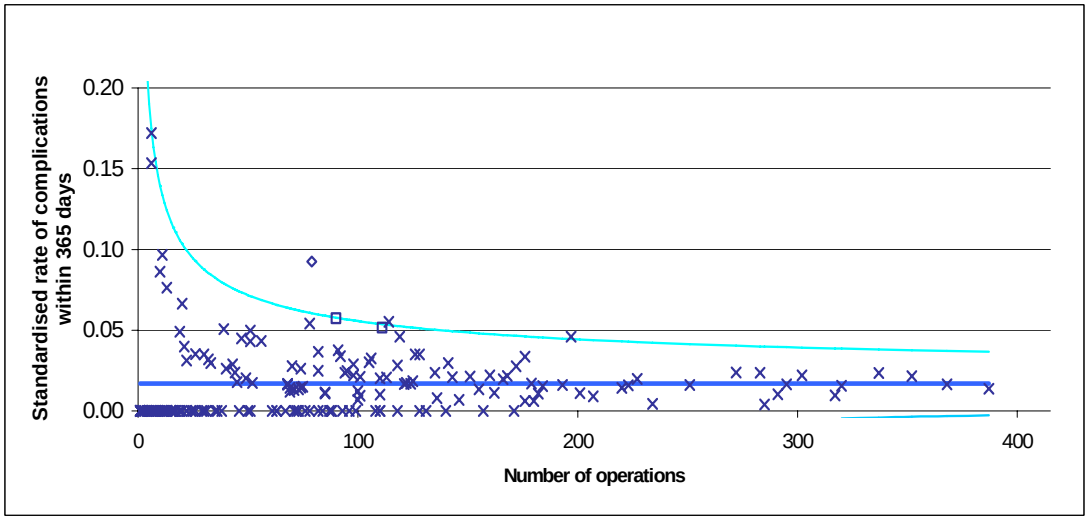
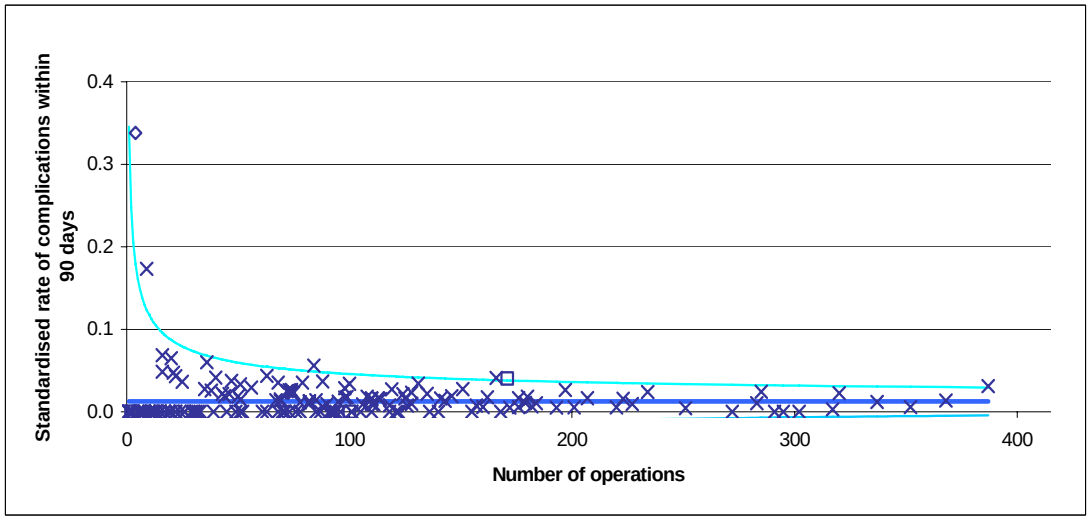


Figure 31 – Observed and expected standardised rates of DVT/PE within 90 days



6. Appendices

6.1. Appendix 1 – Shoulder and Elbow Arthroplasties: Summary

The number of elective and emergency joint replacement operations (for both primary and revision for hip and knee) can be seen in the main report and corresponding information for other upper limb arthroplasties plus toes and ankles in Appendix 9.

Figure 32 to 35 represent the numbers of elective and emergency joint replacement operations, (both primary and revision for shoulder and elbow) recorded as performed in NHS Scotland in each of the last 14 years (1992 to 2005). All numbers are displayed by year ending March. The number of primary shoulder arthroplasties has risen steadily from 1992 to 2005 (130 to 224) with a peak of activity in 1998 (305). There was also an increase in the volume of revision shoulder arthroplasties carried out between 1992 and 2005 (2 to 15). The revision burden (no of revisions expressed as percentage of total) is currently 6.7%.

The volume of primary elbow arthroplasties remained fairly stable until 2001 (approximately 74) and since then has fallen to 63 procedures in 2005. The number of revision elbow replacements has increased between 1992 and 2005 (7 to 10). Most elbow arthroplasties are performed for rheumatoid arthritis. The decline in the number of elbow arthroplasties mirrors the decline noted in hip and knee arthroplasty reported previously for rheumatoid patients (www.show.scot.nhs.uk/arthro). The revision burden for elbow arthroplasty is higher than for shoulders at 13.7%.

Figure 32 – Primary Shoulder Arthroplasties by year ending March

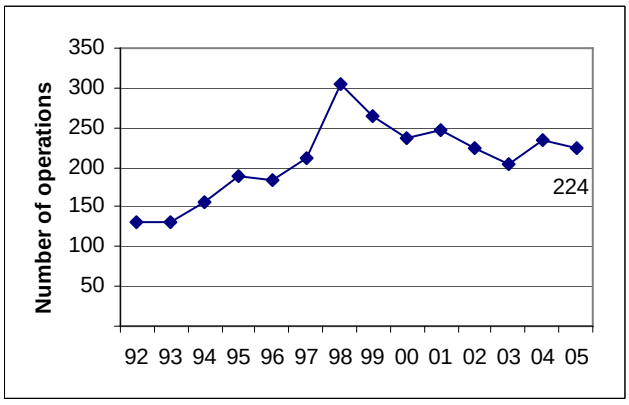


Figure 33 – Revision Shoulder Arthroplasties by year ending March

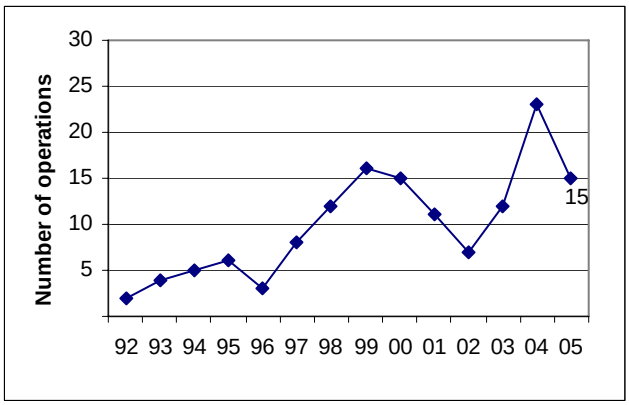


Figure 34 – Primary Elbow Arthroplasties by year ending March

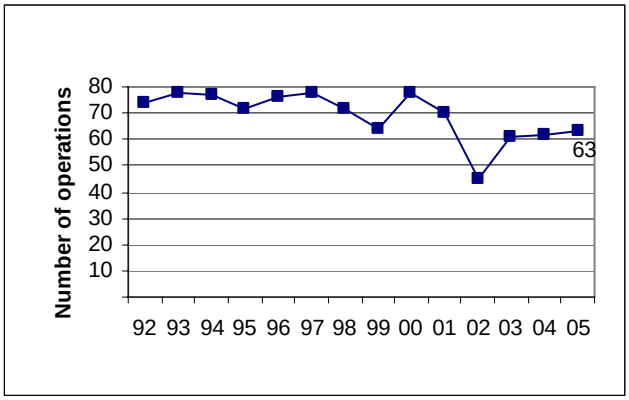
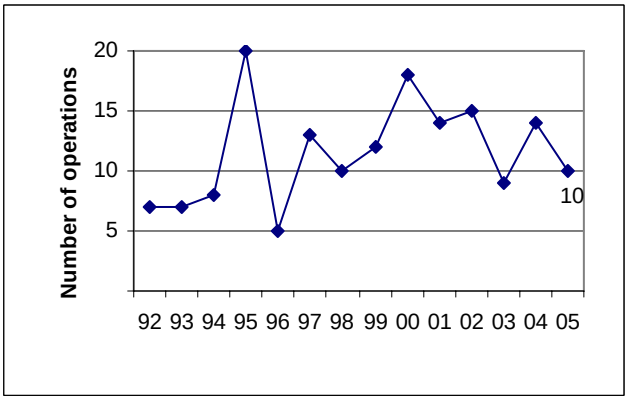


Figure 35 – Revision Elbow Arthroplasties by year ending March



6.1.1. Number of Shoulder and Elbow Arthroplasties Performed per Surgeon

Figure 36 and 37 illustrate the number of primary joint replacements for shoulders and elbows recorded as performed by each consultant surgeon operating in NHS Scotland. Each consultant and hospital has a unique work pattern and arthroplasty represents only a small part of that workload. These figures should therefore not be seen as total workload figures. It should also be noted that consultants commencing or retiring from their post during the year may well appear to be performing low volumes of procedures if they were not working for the whole year.

A total of 67 consultant surgeons are recorded as having performed primary shoulder replacements in 2005 in the NHS. There were 53 consultant surgeons (79%) who performed less than 5 primary shoulder replacements. It is probable that the majority of cases performed by small number surgeons were for traumatic rather than elective indications.

Nineteen consultant surgeons performed primary elbow replacements in 2005. Fifteen of these consultant surgeons (79%) performed less than 5 primary elbow replacements.

Figure 36 – Primary Shoulder Arthroplasties for year ending March 2005

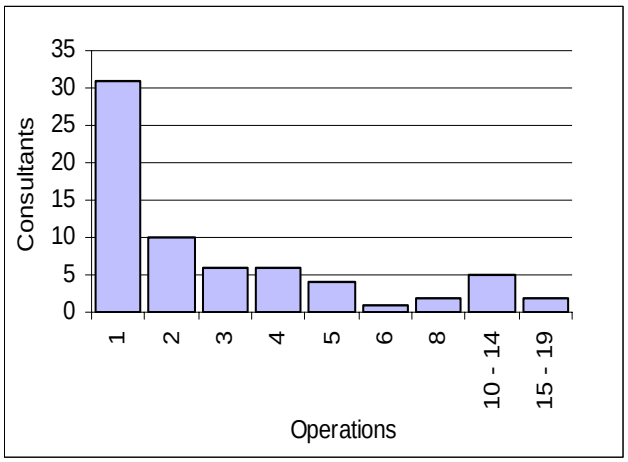
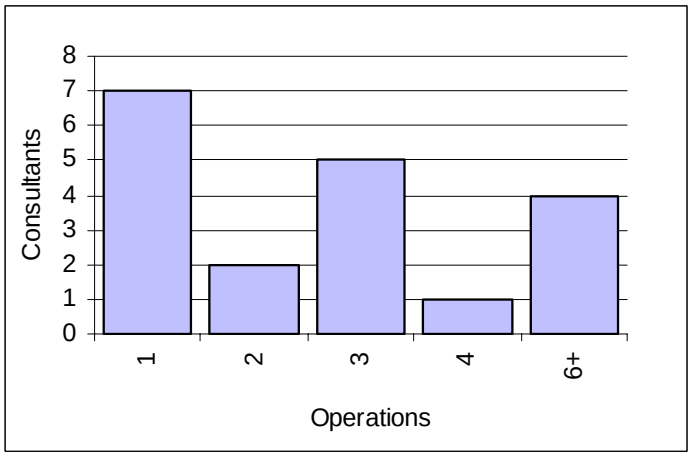


Figure 37 – Primary Elbow Arthroplasties for year ending March 2005



6.1.2. Kaplan-Meier Survival of Shoulder Joint Replacements

Patients who had their joint replaced between April 1993 – March 2005 were followed for up to 12 years after their operation and the number of replacements and revisions included are based on 12 years of SMR01 data. However, for graphical presentation, we have truncated the survival curves at 11 years as the last year of data presented has less than 10% of the patients contributing to it and is hence the most variable.

At day 0, no patients have had their joint revised and hence the survival is always 1. When a patient has a joint revised, the survival rate drops. In this case, a higher survival rate is better.

For the comparison of survival, we used the Log-rank test to see if there was a difference in survival between the groups of patients (Bland et al 2004).

Table 8 and Figures 38 to 40 show survival of primary shoulder replacements. The 10-year survival (taking revision for all causes as an endpoint) in Scotland is 96% with no statistically different outcome types of hospital admission (p=0.59). For patients presenting with arthritis, survival differs significantly by type. Survival at 10 years for patients presenting with osteoarthritis is 93.5% compared to 89.5% for those presenting with rheumatoid arthritis (p=0.01).

Table 8 – National Survival of Primary Shoulder Replacements: April 1993 – March 2005

	Total primary shoulder replacements	Surviving to end point/dying before end point
Figure 38 Revision after Primary Shoulder Replacement		
All shoulders	2476	2417
Figure 39 Type of hospital admission		
Elective	1659	1615
Non Elective	725	711
Transfer	92	91
Figure 40 Type of arthritis		
Osteoarthritis	337	322
Rheumatoid arthritis	642	630
Other	1497	1465

Figure 38 – Revision after Primary Shoulder Replacement: April 1993 - March 2005

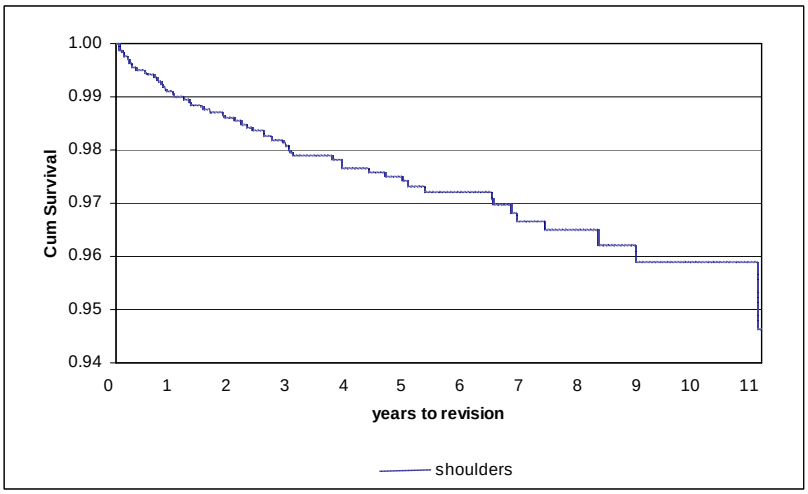


Figure 39 – Revision after Primary Shoulder Replacement by type of admission: April 1993- March 2004

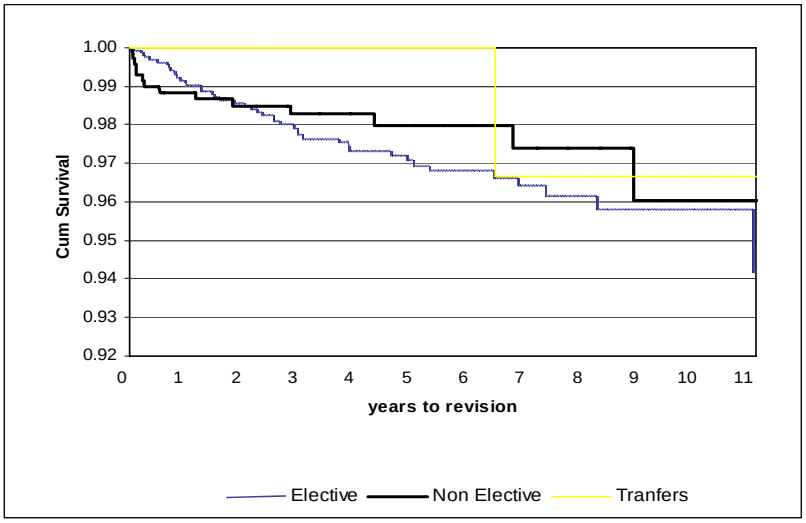
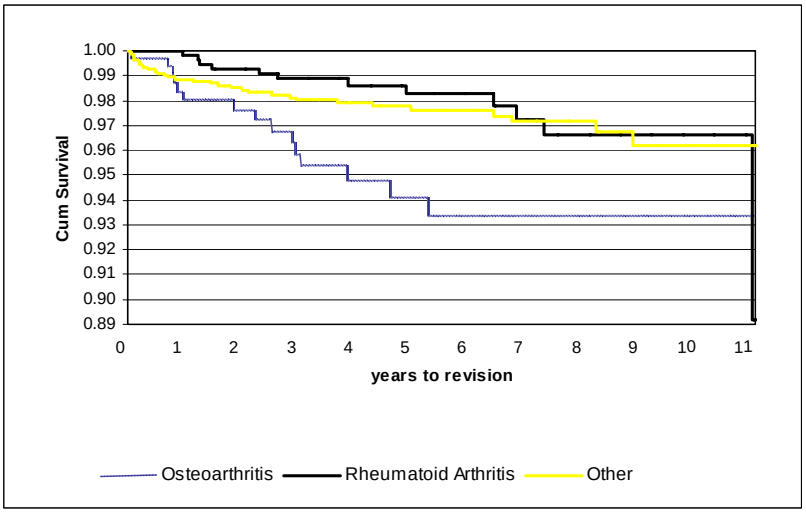


Figure 40 – Cumulative probability of survival of shoulder arthroplasties against time to revision by type of arthritis.



6.2. Appendix 2 – Additional National Trends in Numbers of Operations

The number of elective and emergency joint replacement operations (for both primary and revision for hip and knee) can be seen in the main report and corresponding information for shoulders and elbows is in Appendix 1.

Figure 41 to 47 represent the number of elective and emergency joint replacement operations, (primary and revision separately for finger and wrist and primary replacements for thumb, toe and ankle) recorded as performed in NHS Scotland in each of the last 13 years (1992 to 2005). All numbers are displayed by year ending March. The vast majority of operations were performed as an elective procedure. Between 94 and 100% of operations over the period were performed as elective for each of the operations presented (Figure 41 to 49).

Figure 41 shows that the number of primary finger arthroplasties has remained relatively stable at between 40 and 60 procedures from 1992 – 2005. Since 1992, there has also been little change in the number of finger revisions with only 2 recorded in 2005.

There has been a slight increase in the number of primary wrist arthroplasties performed from 10 operations in 1992 to 27 operations in 1996. Between 2000 and 2004, the volume of wrist arthroplasties has remained static at around 10 operations per year. However, there has been a slight increase to 15 operations in 2005. The number of wrist revisions has also remained relatively constant at around 1 operation over the last 13 years.

The number of thumb arthroplasties carried out each year has increased from 6 to 30 operations between 1992 and 2003, thereafter, the number of operations carried out has decreased to 15 in 2004, but an increase of 9 from 15 to 24 occurred in 2005 (Figure 45).

The number of toe arthroplasties has slowly decreased over time. There were 46 toe procedures recorded in 1992, but this has decreased by 39% to 18 in 2005 (Figure 46).

From 1992 to 1998 the number of ankle arthroplasties has remained relatively constant with only 1 or 2 occurring. Since 1998, however, there has been a steady increase in the number of ankle arthroplasties carried out. The number of procedures has risen from 1 in 1998 to 27 in 2005.

Figure 41 – Primary Finger Arthroplasties by year ending March

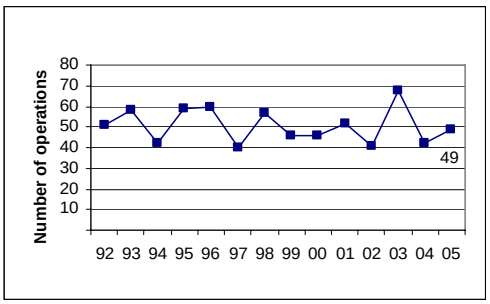


Figure 42 – Revision Finger Arthroplasties by year ending March

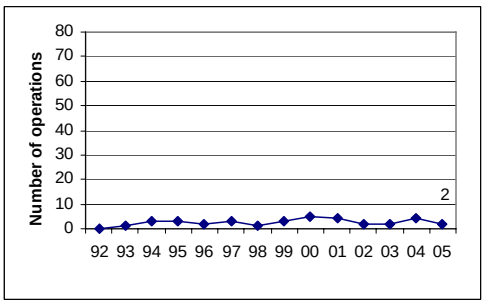


Figure 43 – Primary Wrist Arthroplasties by year ending March

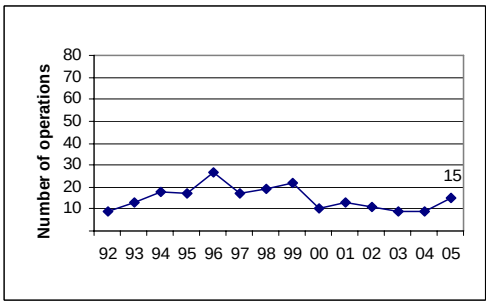


Figure 44 – Revision Wrist Arthroplasties by year ending March

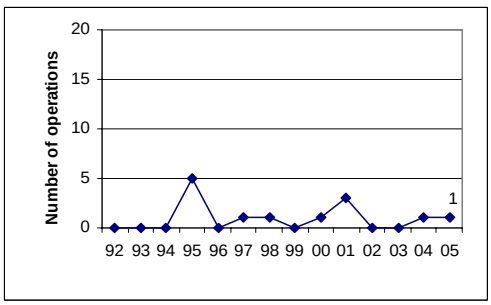


Figure 45 – Thumb Arthroplasties by year ending March

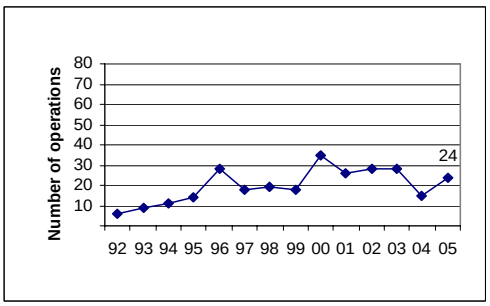


Figure 46 – Toe Arthroplasties by year ending March

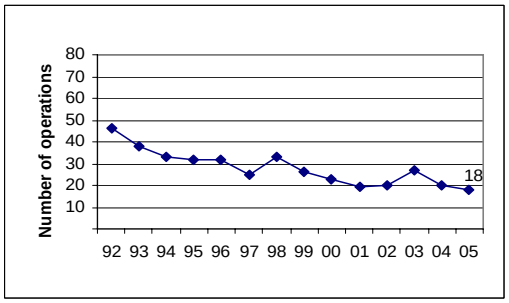
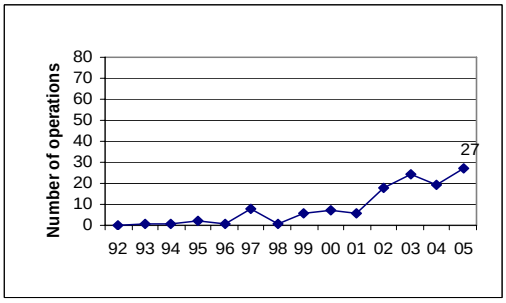


Figure 47 – Ankle Arthroplasties by year ending March



6.3. Appendix 3 – Average Length of Stay Analysis

Figure 48 and 49 show the median length of stay per continuous inpatient stay in each NHS Board for each of the ten years between 1995/96 and 2004/05 for elective primary hip and elective primary knee replacements respectively. The median length of stay is the period within which 50% of patients have gone home. This probably represents custom and practice within the health service in that area.

Over the course of the last ten years, there has been a steady drop in the median length of stay for patients having hip replacements. The largest decrease was 7 days in both NHS Argyll and Clyde and NHS Highland. However, there has been a slight increase in the median length of stay from 11 days to 14 days across the decade for the Western Isles NHS Board. It should be noted that this was the only NHS board where a rise was seen and could be insignificant due to the relatively small number of hip replacements carried out in this board.

With knee replacements there was again a general downward trend in median over the ten years across the NHS Boards. The average drop in median over the decade was 6 days. The greatest impact on median was seen in NHS Borders and NHS Highland where the median decreased by 8 from 16 to 8 and 15 to 7 days respectively. There was a slight increase of 2 days in the median length of stay over the ten years in NHS Western Isles - from 12 in 1995/96 to 16 in 2004/05. However this was the only NHS Board where a rise was seen over the decade which can be explained by the relatively small number of operations carried out in this Board with an average of 13 per year.

Figure 48 and 49 show the average length of stay for elective primary hip and elective primary knee replacements respectively in each of the last ten years (1996 to 2005). All numbers are displayed by year ending March.

Figure 48 – Average Length of Stay per Continuous Inpatient Stay for Hip Replacements by year ending March

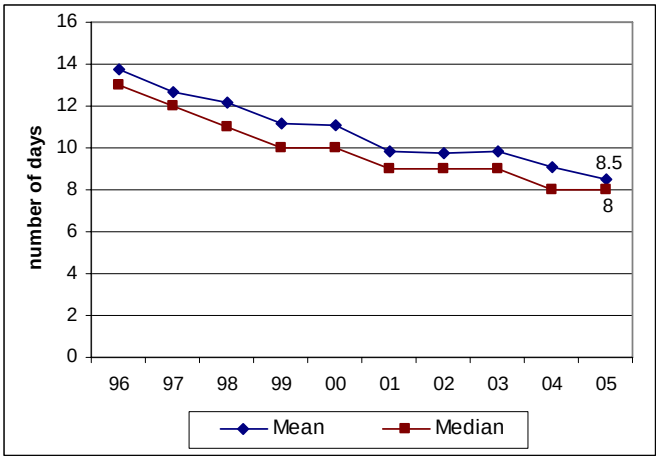


Figure 49 – Average Length of Stay per Continuous Inpatient Stay for Knee Replacements by year ending March

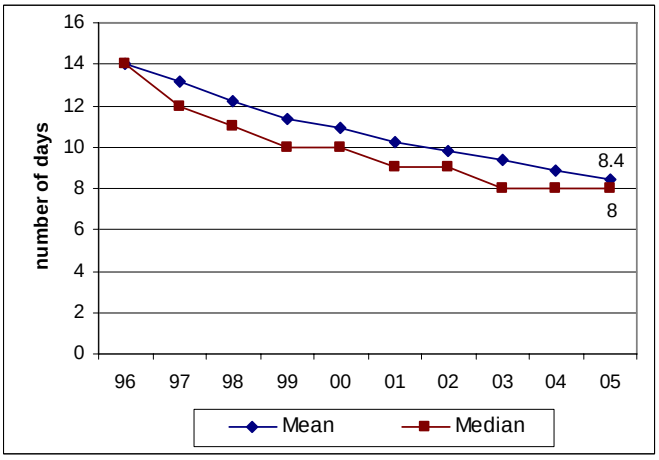


Table 9 – Median Length of Stay per Continuous Inpatient Stay for Hip Replacements

	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Scotland	**13**	**12**	**11**	**10**	**10**	**9**	**9**	**9**	**8**	**8**
Argyll & Clyde	14	14	12	11	10	9	9	9	8	7
Ayrshire & Arran	12	12	12	12	10	9	9	9	8	9
Borders	12	11	11	10	9	9	9	9	8	8
Dumfries & Galloway	13	12	11	10	10	9	9	9	9	9
Fife	10	9	9	9	8	8	8	8	8	8
Forth Valley	12	12	12	13	12	11	10	10	9	8
Golden Jubilee Hospital	-	-	-	-	-	-	-	9	8	7
Grampian	13	12	12	11	11	10	10	10	9	8
Highland	14	12	11	11	10	8	7	7	7	7
Lanarkshire	15	15	14	11	11	10	9	9	8	9
Lothian	11	9	9	8	7	7	7	7	7	7
North Glasgow	13	10	10	9	9	8	9	8	8	7
South Glasgow	13	12	11	10	9	9	9	9	8	8
Tayside	14	13	12	11	11	10	9	9	8	8
Western Isles	11	11	11	10	14	11	11	10	14	14

Table 10 – Median Length of Stay per Continuous Inpatient Stay for Knee Replacements

	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Scotland	**14**	**12**	**11**	**10**	**10**	**9**	**9**	**8**	**8**	**8**
Argyll & Clyde	14	14	12	10	10	9	9	8	8	7
Ayrshire & Arran	14	13	12	11	11	9	9	8	8	9
Borders	16	14	14	13	11	10	9	9	9	8
Dumfries & Galloway	15	14	12	12	11	11	10	10	11	10
Fife	12	10	9	9	8	8	8	8	8	8
Forth Valley	12	13	11	13	13	11	11	10	9	9
Golden Jubilee Hospital	-	-	-	-	-	-	-	9	8	7
Grampian	14	13	13	11	11	10	10	10	9	8
Highland	15	14	14	11	9	8	8	7	7	7
Lanarkshire	15	16	15	12	13	10	9	9	8	8
Lothian	12	11	9	8	8	8	7	7	7	7
North Glasgow	14	10	9	9	9	9	9	8	8	7
South Glasgow	13	12	11	10	9	9	9	8	8	8
Tayside	14	13	12	11	11	9	9	9	8	8
Western Isles	12	11	14	11	8	11	11	13	14	16

Table 11 – Mean Length of Stay per Continuous Inpatient Stay for Hip Replacements

	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Scotland	**13.7**	**12.7**	**12.1**	**11.2**	**11.0**	**9.8**	**9.8**	**9.8**	**9.1**	**8.5**
Argyll & Clyde	14.3	14.0	12.7	11.7	11.1	10.0	9.6	8.9	8.0	7.1
Ayrshire & Arran	13.2	12.5	12.6	12.5	11.9	10.5	10.4	10.2	10.1	9.6
Borders	12.4	11.9	11.7	10.2	9.5	9.2	8.8	8.7	7.8	7.6
Dumfries & Galloway	14.9	14.5	11.8	12.2	11.9	10.4	11.0	10.9	10.6	10.7
Fife	11.3	11.2	10.2	10.2	9.8	8.7	9.1	9.1	9.2	9.2
Forth Valley	12.4	12.2	12.2	13.7	14.6	12.3	11.5	12.0	9.7	9.1
Golden Jubilee Hospital	-	-	-	-	-	-	-	10	8.8	7.4
Grampian	14.0	12.8	12.4	11.5	12.6	10.6	10.3	10.5	9.5	9.0
Highland	13.8	14.1	12.8	12.4	10.3	9.0	8.3	9.4	8.5	8.5
Lanarkshire	16.2	16.0	14.4	11.3	12.2	11.3	10.3	10.8	9.9	10.0
Lothian	13.1	10.9	10.4	8.7	8.6	8.2	7.8	8.3	7.8	7.5
North Glasgow	14.3	11.4	11.7	10.7	9.3	9.1	9.6	9.2	9.3	8.8
South Glasgow	15.0	13.9	12.2	11.0	11.0	9.8	11.4	10.7	9.4	8.4
Tayside	14.1	13.0	13.3	12.2	12.3	10.3	10.1	10.7	9.3	8.4
Western Isles	13.2	12.3	11.8	11.2	13.5	14.9	13.6	13.9	15.2	14.6

Table 12 – Mean Length of Stay per Continuous Inpatient Stay for Knee Replacements

	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Scotland	**14.0**	**13.2**	**12.2**	**11.3**	**10.9**	**10.2**	**9.8**	**9.3**	**8.9**	**8.4**
Argyll & Clyde	14.2	14.0	12.8	10.9	10.4	9.3	9.3	8.8	7.7	8.0
Ayrshire & Arran	13.9	12.8	12.6	12.1	11.5	10.9	10.7	9.7	9.4	10.2
Borders	16.7	15.1	14.7	13.2	11.7	10.4	9.4	8.6	8.6	7.9
Dumfries & Galloway	15.3	13.7	13.0	12.9	11.5	12.2	10.7	10.7	12.1	11.7
Fife	12.4	10.5	10.2	9.3	9.1	9.6	8.4	8.8	9.2	9.6
Forth Valley	13.6	13.1	12.3	13.1	13.5	12.2	11.4	11.0	10.4	9.5
Golden Jubilee Hospital	-	-	-	-	-	-	-	9.8	8.7	7.9
Grampian	14.6	13.7	13.3	12.9	12.0	11.2	10.4	10.3	10.0	9.0
Highland	15.1	14.4	13.9	13.1	10.4	9.2	8.6	9.1	8.3	7.4
Lanarkshire	16.7	17.3	14.6	12.7	13.0	11.3	10.5	9.6	9.2	8.8
Lothian	13.5	12.0	10.2	8.9	9.0	8.3	7.7	7.7	7.0	7.1
North Glasgow	14.6	11.9	10.7	10.6	10.1	9.8	10.0	9.4	8.7	8.1
South Glasgow	13.7	13.5	12.1	11.3	10.8	10.5	12.0	10.3	9.5	9.1
Tayside	13.4	14.1	12.9	12.1	11.6	10.8	10.2	9.5	8.6	7.9
Western Isles	12.0	12.3	17.6	14.4	9.7	11.5	9.6	13.5	13.1	14.8

6.4. Appendix 4 – Number of Arthroplasty Procedures Performed per Surgeon

Figure 50 to 53 illustrate the number of joint replacements (primary and revision for both hip and knee) recorded as performed by each consultant surgeon operating in NHSScotland. Each consultant and hospital has a unique work pattern and arthroplasty represents only a small part of that workload. These figures should therefore not be seen as total workload figures. It should also be noted that consultants commencing or retiring from their post during the year may well appear to be performing low volumes of procedures if they were not working for the whole year.

A total number of 169 consultant surgeons are recorded as having performed primary hip replacements in 2005 in the NHS. There were 24 consultant surgeons who performed less than 5 primary hip replacements. Also, 82 out of 124 consultant surgeons (66%) performed less than 5 revisions of primary hip replacements in 2005.

There were 158 consultant surgeons who performed primary knee replacements in 2005. Eighteen of these consultant surgeons (11%) performed less than 5 primary knee replacements, which is higher than 6% that was achieved in 2004. Of the 91 consultant surgeons who performed revisions of primary knee replacements in 2005, there were 29 consultant surgeons (32%) who performed only one revision. This percentage has increased by 1% since 2004.

Previous reports (Scottish Arthroplasty Project 2003) have highlighted that performing low volumes of procedures can result in higher rates of the complications deep vein thrombosis (dvt), infected prosthesis and dislocation of prosthesis, but not in higher rates of revision surgery.

In an attempt to make the data more understandable (and to observe change) annualised figures for the percentage of arthroplasty surgery carried out by surgeons performing less than a specific number of procedures have been reported in Appendix 5 (operations performed by surgeons carrying out small volumes of procedures). This provides another perspective on surgery being carried out by surgeons performing low numbers. However, both this analysis and the charts following are confounded by the turnover of consultant surgeons and locums noted above.

Figure 50 – Primary hip replacements for year ending March 2005

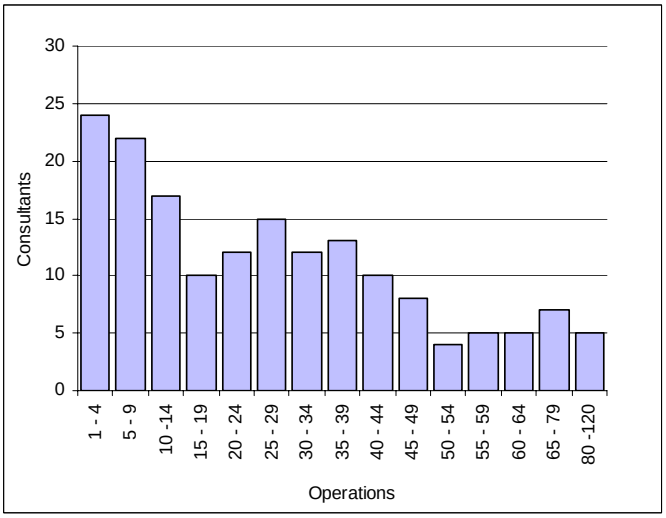


Figure 51 – Primary knee replacements for year ending March 2005

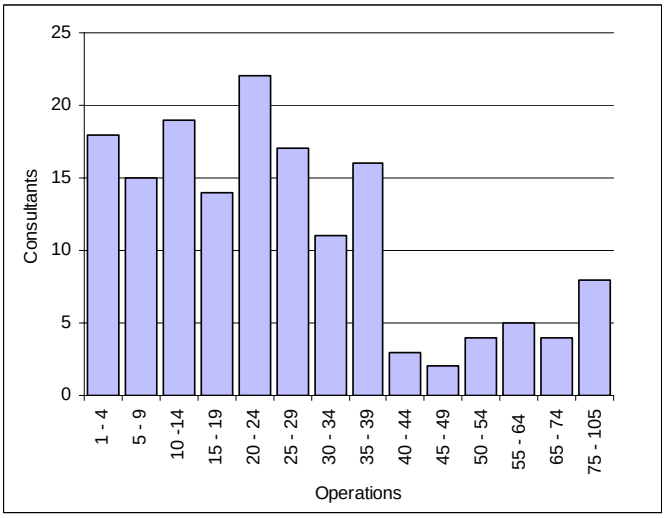


Figure 52 – Revision hip replacements for year ending March 2005

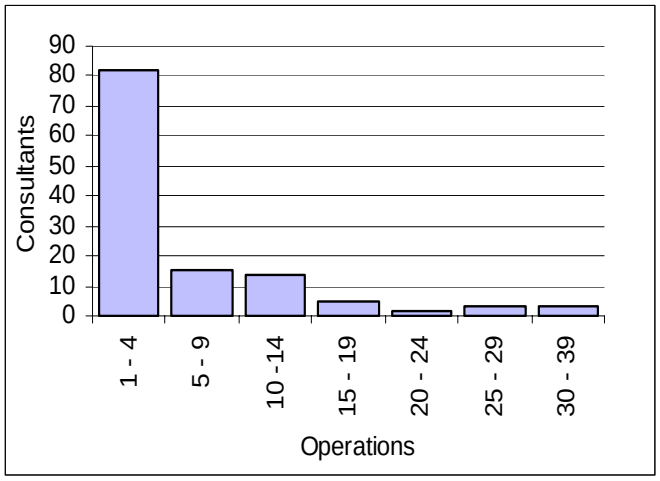
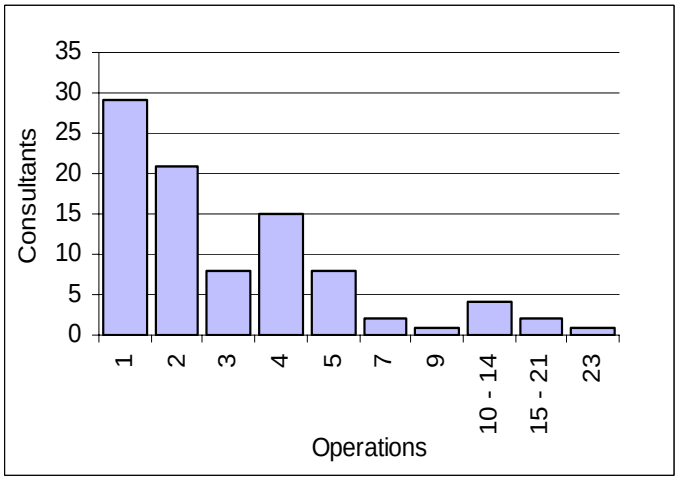


Figure 53 – Revision knee replacements for year ending March 2005



6.5. Appendix 5 – Operations performed by Surgeons Carrying Out Small Volumes of Procedures

Figure 54 and 55 represent the number of primary and revision operations carried out by a surgeon doing less than a specified number of similar operations. This year the limits are 20 and under for primary hip and knee replacements, 10 and under for revision hip replacements and 5 and under for revision knee replacements.

Figure 54 – % of hip replacements by surgeons carrying out small volumes of procedures per year

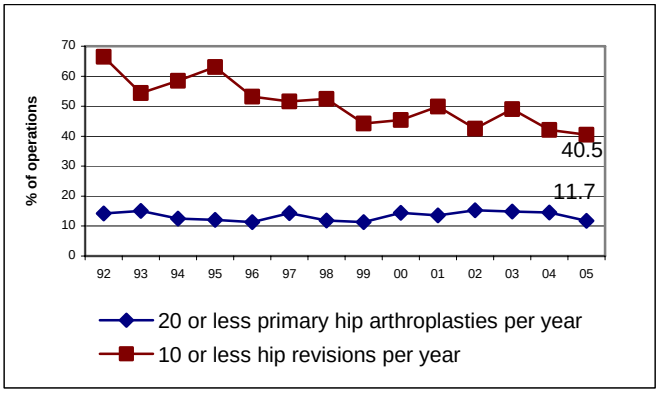


Figure 55 – % of knee replacements by surgeons carrying out small volumes of procedures per year

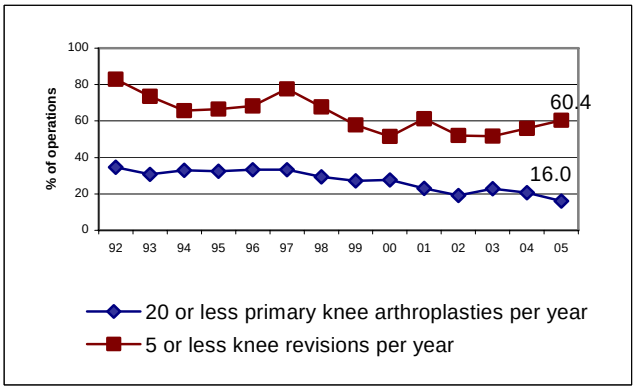


Figure 54 shows that the trend in the percentage of surgeons carrying out 10 or less hip revisions has been steadily decreasing from approximately 70% of operations in 1992 to 40.5% in 2005. From 1999 onwards, the percentage of surgeons performing 10 or less hip revisions has remained consistently between 50% and 40% per year. The number of hip revisions has remained between 10% and 20% of operations from 1992 to 2005.

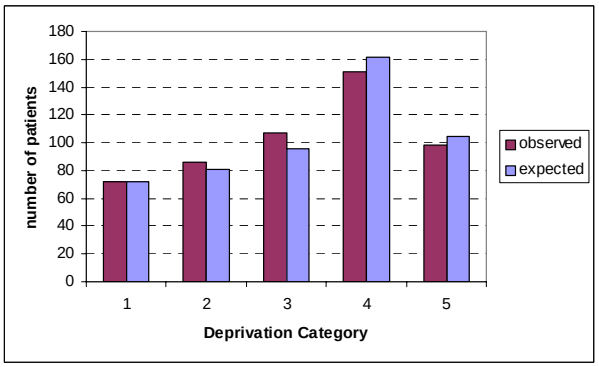
Figure 55 shows an overall decrease in the percentage of surgeons carrying out 5 or less of knee revisions. However, there has been an increase in the percentage of surgeons doing 5 or less revisions per year from 2002 onwards. The percentage of surgeons carrying out 20 or less primary knee arthroplasties has also been steadily decreasing from around 35 percent of operations per year to 16% in 2005.

For several years, consultants have been dissuaded from performing a low volume of arthroplasties and encouraged to pass patients requiring arthroplasty surgery to consultants who perform such surgery more frequently. In doing so, it is hoped that arthroplasty specialists would be created. It is therefore of interest to see if there is a difference in the number of consultants performing a low volume of arthroplasties from year to year.

To be classed as performing a low volume of procedures, a consultant would have to perform 10 or less arthroplasty procedures throughout the entire year.

6.6. Appendix 6 -Observed And Expected Number Of Operations Performed By Deprivation Category

Figure 56 – Expected and Observed Numbers for Primary Hip Replacement by Deprivation Category - Ayrshire and Arran



Chi squared test result p= 0.62

Figure 57 – Standardised Incidence Ratio's by Deprivation Category - Ayrshire and Arran

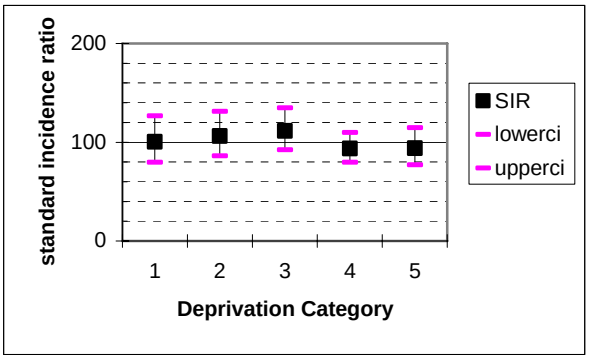
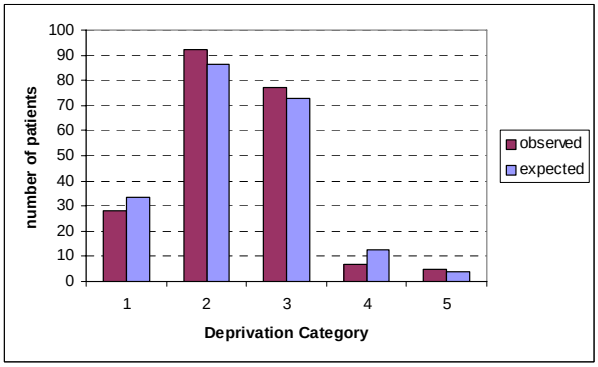


Figure 58 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Borders



Chi squared test result p= 0.38

Figure 59 – Standardised Incidence Ratio's by Deprivation Category – Borders

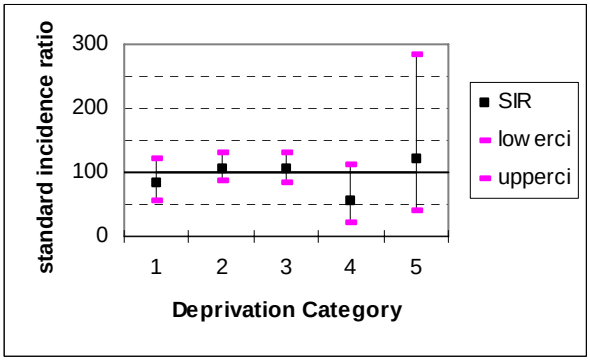
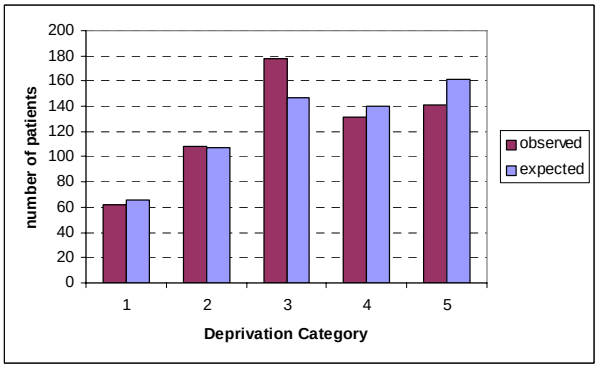


Figure 60 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Argyll and Clyde



Chi squared test result p= 0.04

Figure 61 – Standardised Incidence Ratio's by Deprivation Category – Argyll and Clyde

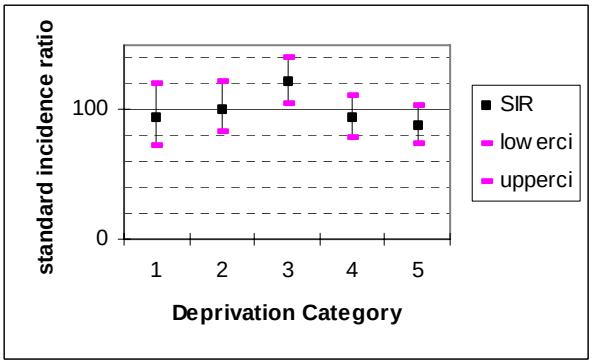


Figure 62 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Fife

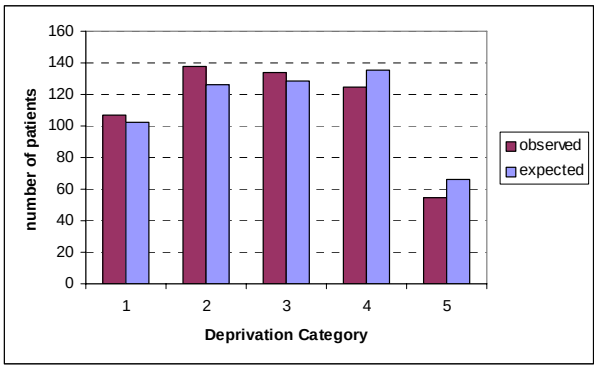
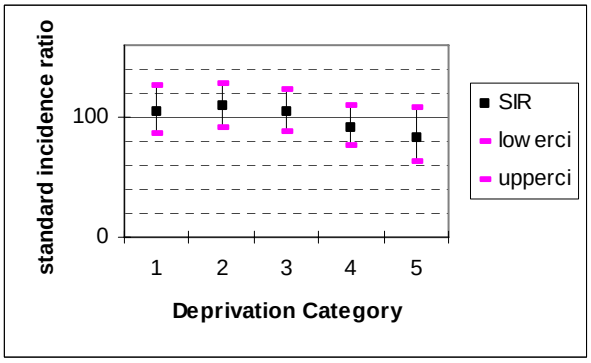
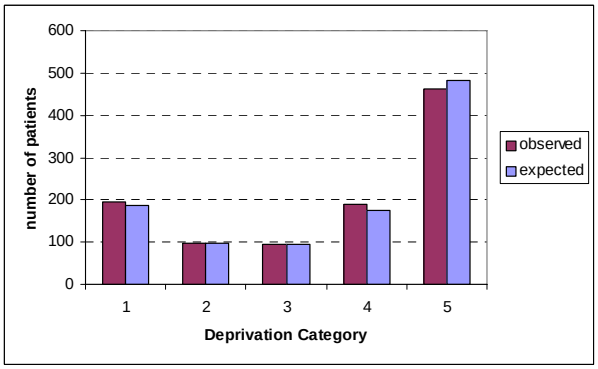


Figure 63 – Standardised Incidence Ratio's by Deprivation Category – Fife



Chi squared test result p= 0.36

Figure 64 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Glasgow



Chi squared test result p= 0.67

Figure 65 – Standardised Incidence Ratio's by Deprivation Category – Glasgow

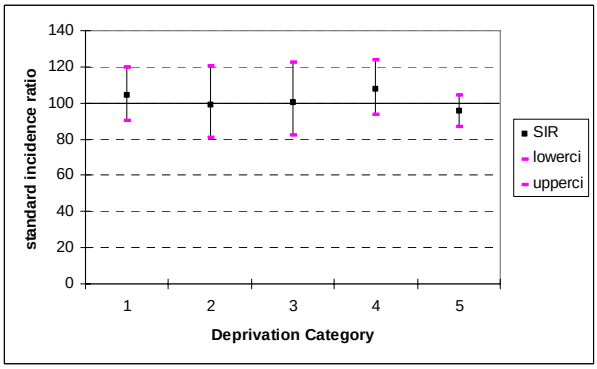
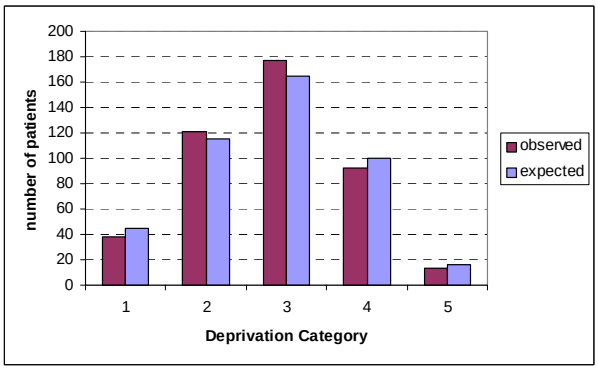


Figure 66 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Highland



Chi squared test result p= 0.48

Figure 67 – Standardised Incidence Ratio's by Deprivation Category – Highland

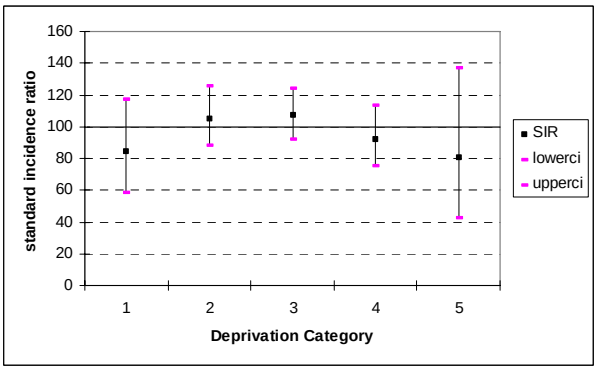
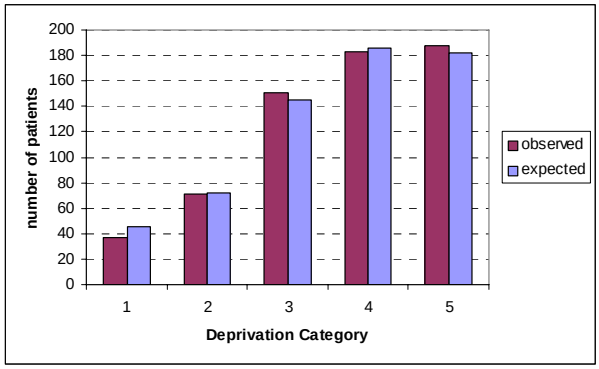


Figure 68 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Lanarkshire



Chi squared test result p= 0.71

Figure 69 – Standardised Incidence Ratio's by Deprivation Category – Lanarkshire

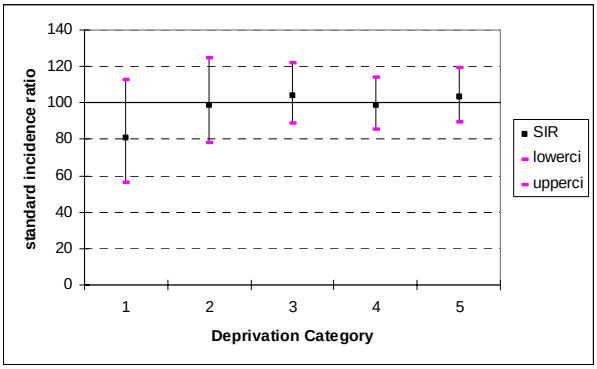
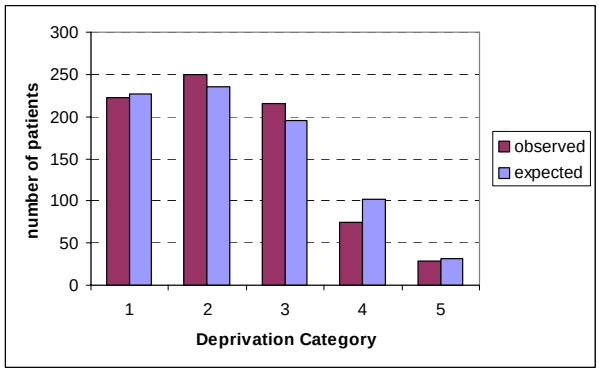


Figure 70 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Grampian



Chi squared test result p= 0.03

Figure 71 – Standardised Incidence Ratio's by Deprivation Category – Grampian

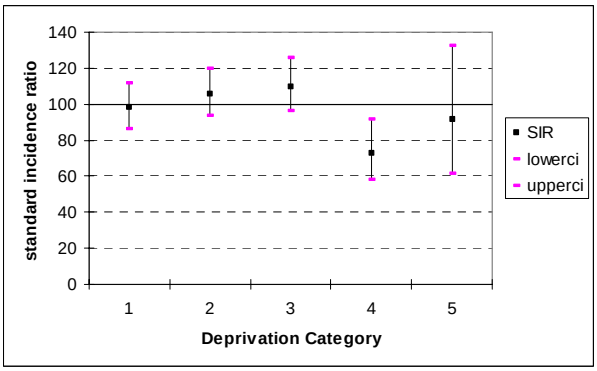
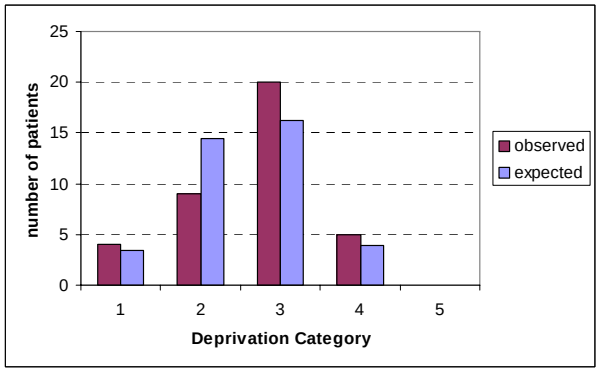


Figure 72 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Orkney Islands



Chi squared test result p= 0.35

Figure 73 – Standardised Incidence Ratio's by Deprivation Category – Orkney Islands

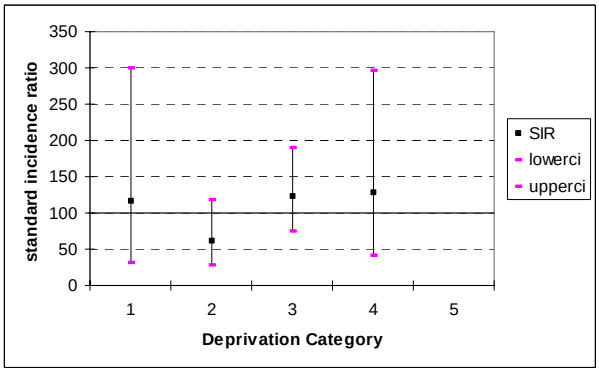
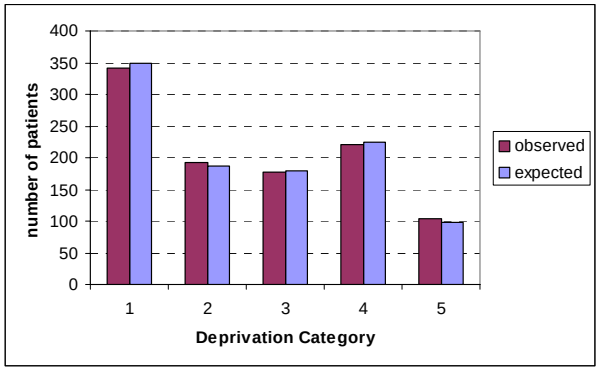


Figure 74 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Lothian



Chi squared test result p= 0.94

Figure 75 – Standardised Incidence Ratio's by Deprivation Category – Lothian

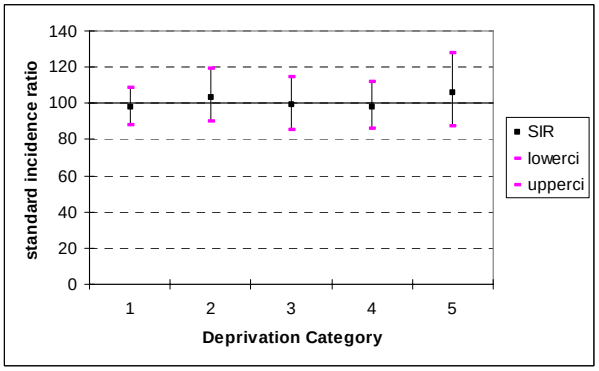
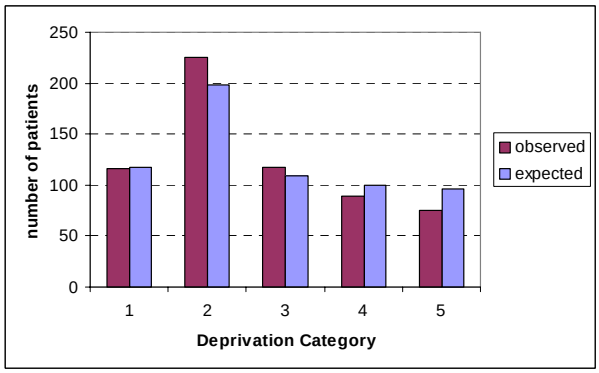


Figure 76 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Tayside



Chi squared test result p= 0.04

Figure 77 – Standardised Incidence Ratio's by Deprivation Category – Tayside

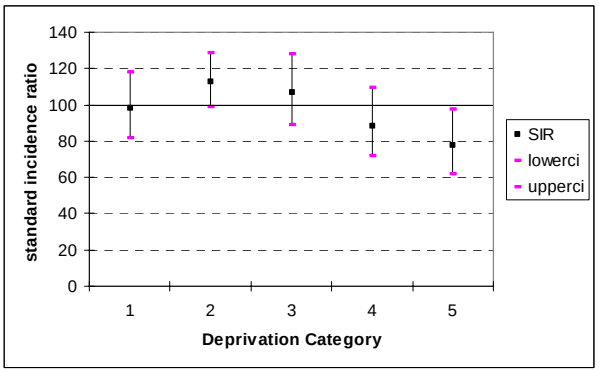
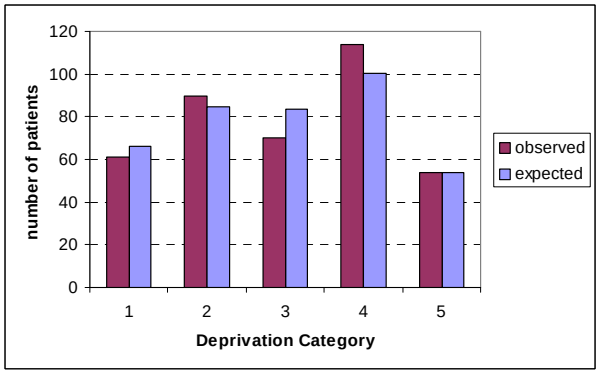


Figure 78 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Forth Valley



Chi squared test result p= 0.32

Figure 79 – Standardised Incidence Ratio's by Deprivation Category – Forth Valley

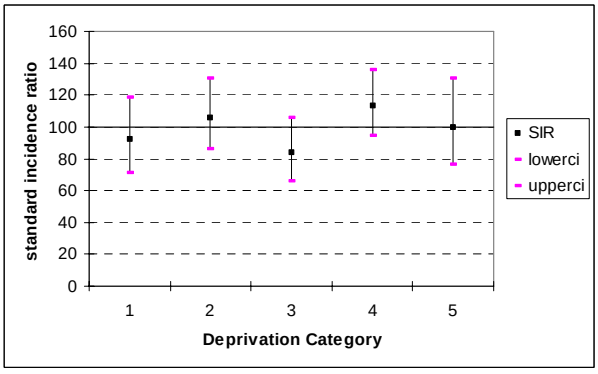
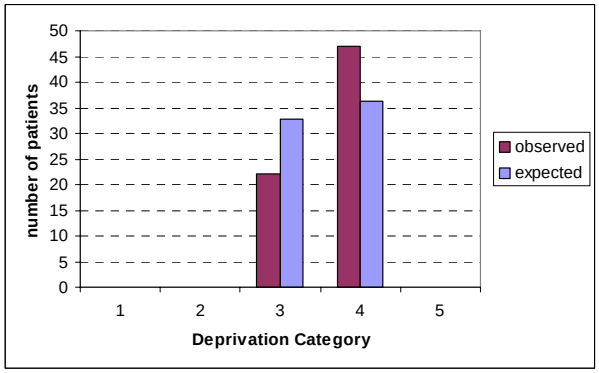


Figure 80 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Western Isles



Chi squared test result p= 0.01

Figure 81 – Standardised Incidence Ratio's by Deprivation Category – Western Isles

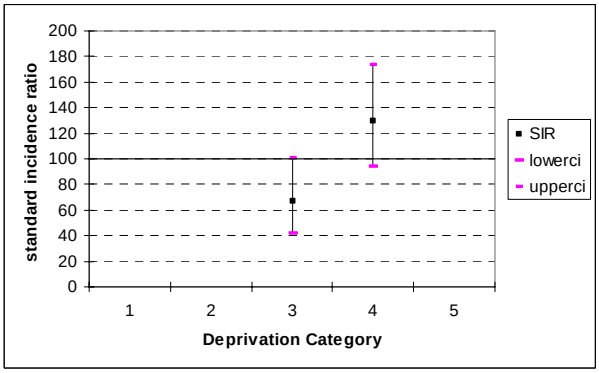
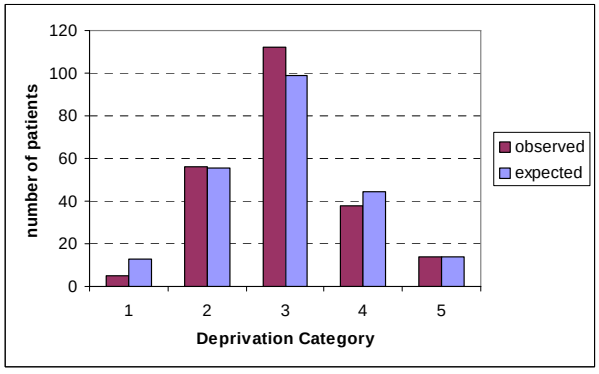


Figure 82 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Dumfries and Galloway



Chi squared test result p= 0.12

Figure 83 – Standardised Incidence Ratio's by Deprivation Category – Dumfries and Galloway

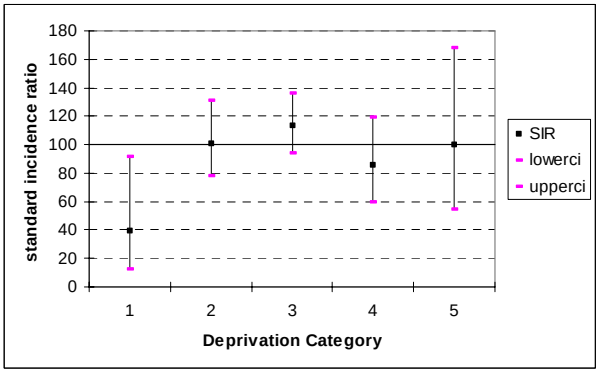
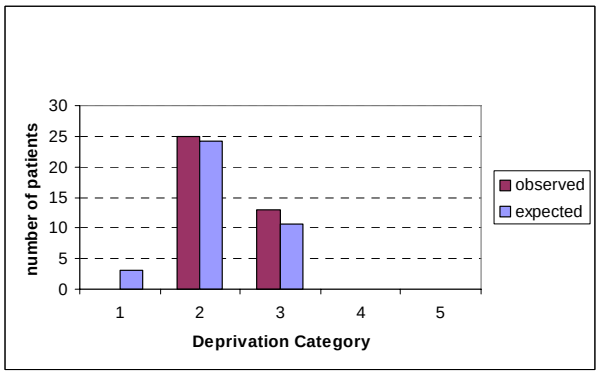
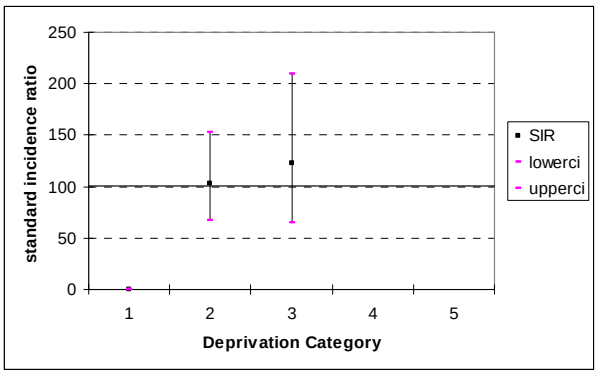


Figure 84 – Expected and Observed Numbers for Deprivation Primary Hip Replacement by Category- Shetland



Chi squared test result p= 0.46

Figure 85 – Standardised Incidence Ratio's by Deprivation Category – Shetland



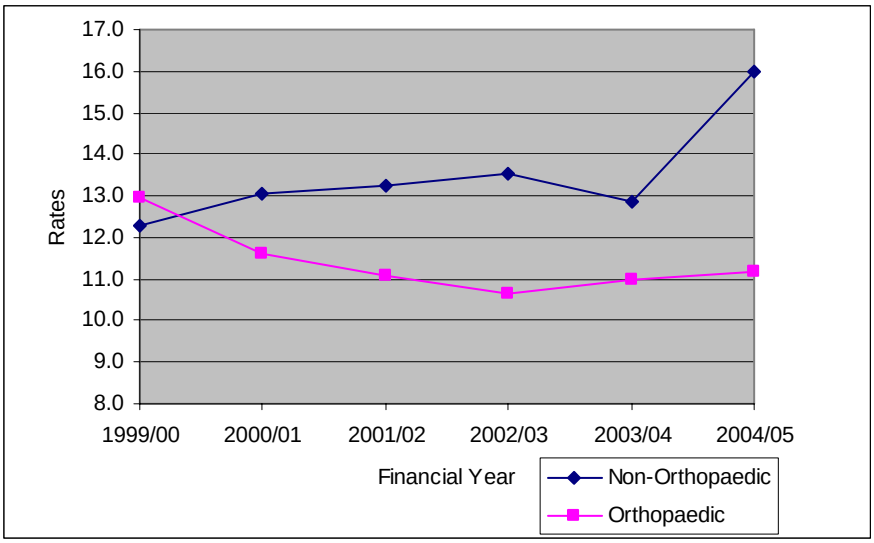
6.7 Appendix 7 - Prolapsed disc

The work in this section is developmental

Background

In 2004/05 1,379 operations were performed on prolapsed discs in Scotland. Figure 86 shows the rate per 100,000 population of lumbar prolapsed disc surgery in Scotland for the financial years 1999/2000 to 2004/05. The rate has been declining slightly since 1999/00 but peaked in the previous financial year to 27 per 100,000.

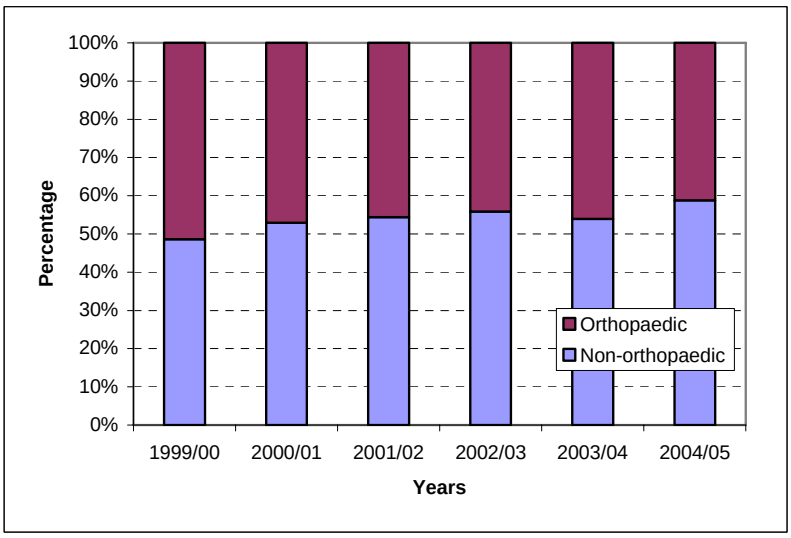
Figure 86 – Rate of lumbar prolapsed disc surgery in Scotland per 100,000 population



The Proportion of Non-orthopaedic surgeons and Orthopaedic surgeons

Both orthopaedic surgeons and Non-orthopaedic surgeons carry out operations on prolapsed disc. Figure 87 shows the proportion carried out by each in Scotland for the past 6 financial years. The proportion of operations performed by an orthopaedic surgeon has declined slightly over the years. It was more than 50% for all NHSScotland in 1999/2000 but there has been approximately a 10% shift towards Non-orthopaedic surgeons in 2004/05 carrying out the procedure.

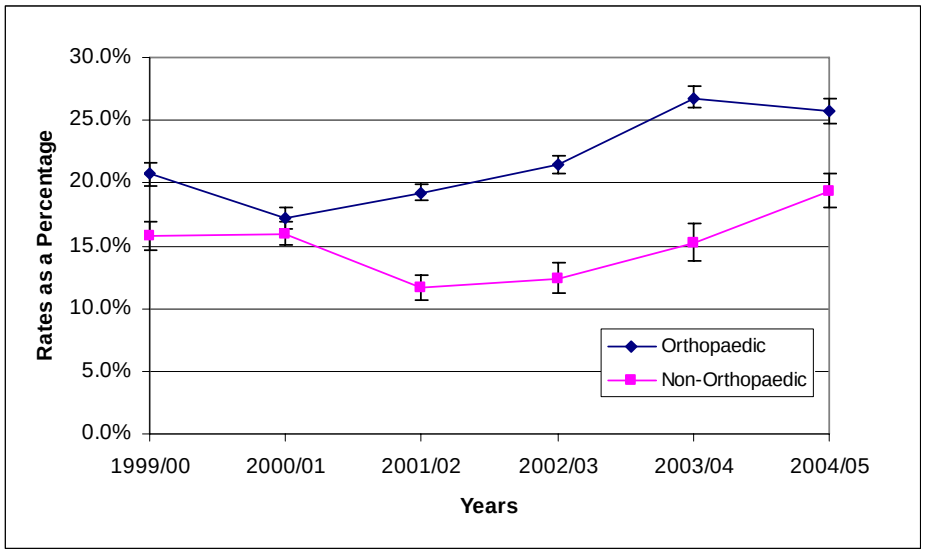
Figure 87 – Percentage of lumbar prolapsed disc surgery performed by Non-orthopaedic surgeon and Orthopaedic surgeon



Number of Readmissions within 365 days after First Operation

Figure 88 shows the rate of readmission for back complaints in Scotland within 365 days of an operation for prolapsed disc, split by and orthopaedic and non-orthopaedic surgeon. The readmission rate for both types of surgeon has risen since 200/01 however overall readmission rates are lower for non-orthopaedic surgeons.

Figure 88 – Rates of Non-orthopaedic surgeon and Orthopaedic surgeon readmissions since April 1999 (with 95% confidence intervals)



The number of readmissions shown in Table 13 is an aggregate of continuous length of stays per patient taken after the first date of operation (DOP). Any further operations are counted as

readmissions if the further DOPs are within 365 days of the first. No further operations after this period are included in the table.

Table 13 – Readmission rates for the period April 2000 to March 2005

	Non-orthopaedic surgeon		Orthopaedic surgeon	
	Number over 5 Years	Percentage of Total operations	Number over 5 Years	Percentage of Total operations
Argyll & Clyde	33	21.6%	30	11.6%
Ayrshire & Arran	31	30.1%	51	25.0%
Borders	13	14.9%	<5	*
Dumfries & Galloway	7	14.3%	18	23.4%
Fife	40	11.2%	34	23.3%
Forth Valley	22	20.4%	31	20.7%
Grampian	74	11.2%	114	25.9%
Greater Glasgow	33	25.6%	194	26.9%
Highland	31	18.5%	25	18.8%
Lanarkshire	61	19.1%	42	24.0%
Lothian	124	13.4%	33	13.0%
Orkney	<5	*	16	39.0%
Shetland	<5	*	14	35.9%
Tayside	44	12.3%	12	8.2%
Western Isles	6	19.4%	<5	*
Scotland	**523**	**15.1%**	**619**	**22.0%**

Further tables on prolapsed disc- for reference

Table 14 – Number of lumbar prolapsed disc surgery episodes and rate per 100,000 by NHS board of residence in Scotland

	1999/00		2000/01		2001/02		2002/03		2003/04		2004/05	
	No.	Rates	No.	Rates	No.	Rates	No.	Rates	No.	Rates	No.	Rates
Argyll and Clyde	83	19.6	65	15.4	79	18.8	84	20.1	86	20.6	97	23.3
Ayrshire and Arran	72	19.4	60	16.3	60	16.3	53	14.4	52	14.2	82	22.3
Borders	25	23.6	15	14.1	10	9.4	18	16.8	25	23.1	34	31.1
Dumfries and Galloway	25	16.9	19	12.9	14	9.5	25	17.0	31	21.1	37	25.0
Fife	139	40.1	115	33.0	114	32.6	106	30.2	68	19.3	100	28.2
Forth Valley	47	16.9	55	19.7	49	17.5	40	14.3	57	20.4	57	20.2
Grampian	186	35.2	198	37.6	203	38.6	230	44.0	254	48.5	217	41.4
Greater Glasgow	190	21.8	153	17.7	189	21.8	175	20.2	158	18.2	175	20.2
Highland	73	34.9	70	33.5	81	38.8	62	29.8	39	18.7	49	23.2
Lanarkshire	77	13.9	116	21.0	99	17.9	79	14.3	83	15.0	118	21.2
Lothian	216	28.0	215	27.7	217	27.9	232	29.8	243	31.2	275	34.9
Orkney Islands	10	51.5	8	41.5	6	31.2	5	26.0	13	67.3	13	66.7
Shetland Islands	13	57.8	11	49.6	12	54.6	8	36.5	8	36.6	14	63.8
Tayside	106	27.0	136	34.8	96	24.7	90	23.2	81	21.0	102	26.3
Western Isles	15	55.1	11	41.1	*	*	9	34.4	8	30.7	9	34.3
Scotland	**1,277**	**25.2**	**1,247**	**24.6**	**1,233**	**24.3**	**1,216**	**24.1**	**1,206**	**23.8**	**1,379**	**27.2**

- **Numbers less than 5 have been anonymised due to patient confidentiality issues**

Figure 89 – Rates of lumbar disc surgery per 100,00 population with 95% confidence intervals by Health Board or residence for 2004/05

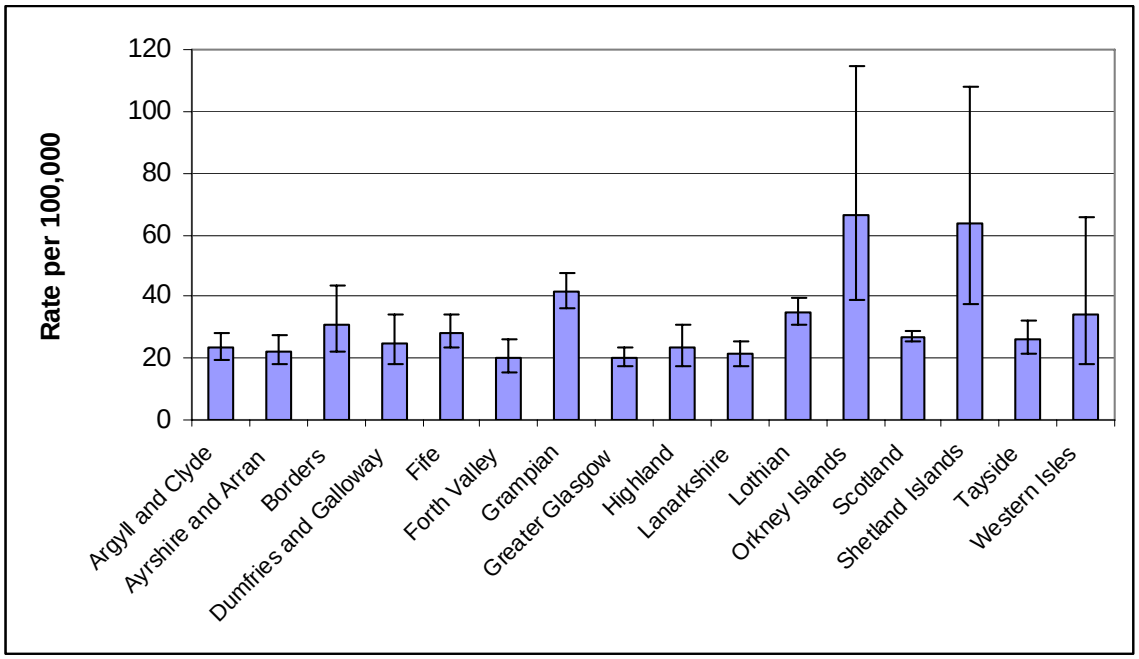


Table 15 – Rate of lumbar prolapsed disc surgery performed by Non-orthopaedic surgeon by NHS board of residence in Scotland per 100,000 population

	Total no. of cases 1999 to 2005	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Argyll and Clyde	**188**	8.3	7.6	7.6	6.9	5.3	9.1
Ayrshire and Arran	**110**	1.9	3.0	3.5	4.1	6.0	11.4
Borders	**102**	14.2	10.4	8.4	13.0	19.4	29.3
Dumfries and Galloway	**58**	6.1	4.7	3.4	5.4	7.5	12.2
Fife	**440**	23.9	21.0	22.6	23.7	14.2	20.3
Forth Valley	**115**	2.5	7.2	6.4	5.4	10.0	9.6
Grampian	**784**	23.1	20.7	21.3	27.5	26.9	29.8
Greater Glasgow	**147**	2.1	2.9	2.8	3.1	2.4	3.7
Highland	**204**	17.2	20.6	24.4	15.4	9.6	10.4
Lanarkshire	**362**	7.6	11.6	11.9	9.4	10.5	14.4
Lothian	**1090**	21.0	20.1	23.5	24.3	25.1	25.9
Orkney Islands	*****	0.0	5.2	0.0	0.0	5.2	10.3
Shetland Islands	**18**	17.8	27.1	13.7	4.6	0.0	18.2
Tayside	**431**	18.6	23.8	18.8	16.3	14.0	19.3
Western Isles	**39**	29.4	33.6	11.3	26.7	19.2	26.7
Scotland	**4092**	**12.3**	**13.1**	**13.2**	**13.5**	**12.9**	**16.0**

Table 16 – Rate of lumbar prolapsed disc surgery performed by orthopaedic surgeon by NHS board of residence in Scotland per 100,000 population

	Total no. of cases 1999 to 2005	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Argyll and Clyde	**306**	11.3	7.8	11.2	13.1	15.3	14.2
Ayrshire and Arran	**269**	17.5	13.3	12.8	10.4	8.2	10.9
Borders	**25**	9.5	3.8	0.9	3.7	3.7	1.8
Dumfries and Galloway	**93**	10.8	8.1	6.1	11.5	13.6	12.8
Fife	**202**	16.1	12.1	10.0	6.6	5.1	7.9
Forth Valley	**190**	14.4	12.5	11.1	8.9	10.4	10.6
Grampian	**504**	12.1	16.9	17.3	16.4	21.6	11.6
Greater Glasgow	**893**	19.7	14.8	19.0	17.1	15.8	16.5
Highland	**170**	17.7	12.9	14.4	14.4	9.1	12.8
Lanarkshire	**210**	6.3	9.4	6.0	4.9	4.5	6.8
Lothian	**308**	7.0	7.6	4.4	5.5	6.0	9.0
Orkney Islands	**51**	51.5	36.3	31.2	26.0	62.1	56.4
Shetland Islands	**48**	40.0	22.5	41.0	31.9	36.6	45.6
Tayside	**180**	8.4	11.0	5.9	7.0	7.0	7.0
Western Isles	**17**	25.7	7.5	3.8	7.6	11.5	7.6
Scotland	**3466**	**12.9**	**11.6**	**11.1**	**10.6**	**11.0**	**11.2**

Table 16 shows the number and rates for lumbar prolapsed disc surgeries performed by an orthopaedic surgeon by NHS board for financial years (1st April to 31st March) 1999/2000 to 2004/2005. Since 2000/2001, NHS Borders has had the lowest rate of operations by an orthopaedic surgeon in NHS Scotland. NHS Orkney and Shetland have consistently had the highest rate, although numbers are very small. NHS Greater Glasgow completed more than 25% of all operations by an orthopaedic surgeon in NHS Scotland in 2004/2005.

Table 17 – Percentage of lumbar prolapsed disc surgery performed by orthopaedic surgeon by NHS board of residence in Scotland

	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
Argyll and Clyde	57.8%	50.8%	59.5%	65.5%	74.4%	60.8%
Ayrshire and Arran	90.3%	81.7%	78.3%	71.7%	57.7%	48.8%
Borders	40.0%	26.7%	10.0%	22.2%	16.0%	5.9%
Dumfries and Galloway	64.0%	63.2%	64.3%	68.0%	64.5%	51.4%
Fife	40.3%	36.5%	30.7%	21.7%	26.5%	28.0%
Forth Valley	85.1%	63.6%	63.3%	62.5%	50.9%	52.6%
Grampian	34.4%	44.9%	44.8%	37.4%	44.5%	28.1%
Greater Glasgow	90.5%	83.7%	87.3%	84.6%	86.7%	81.7%
Highland	50.7%	38.6%	37.0%	48.4%	48.7%	55.1%
Lanarkshire	45.5%	44.8%	33.3%	34.2%	30.1%	32.2%
Lothian	25.0%	27.4%	15.7%	18.5%	19.3%	25.8%
Orkney Islands	100.0%	87.5%	100.0%	100.0%	92.3%	84.6%
Shetland Islands	69.2%	45.5%	75.0%	87.5%	100.0%	71.4%
Tayside	31.1%	31.6%	24.0%	30.0%	33.3%	26.5%
Western Isles	46.7%	18.2%	25.0%	22.2%	37.5%	22.2%
Scotland	**51.4%**	**47.1%**	**45.6%**	**44.2%**	**46.1%**	**41.2%**

Figures 90 and 91 show the median average length of stay for lumbar prolapsed disc operations performed by Non-orthopaedic surgeons and orthopaedic surgeons by NHS board for financial year (1st April to 31st March) 2004/2005.

Overall, the median length of stay is less under orthopaedic surgeons than for Non-orthopaedic surgeons.

Figure 90 – Median, 25th and 75th percentile of length of stay for Non-orthopaedic surgeons by Health Board

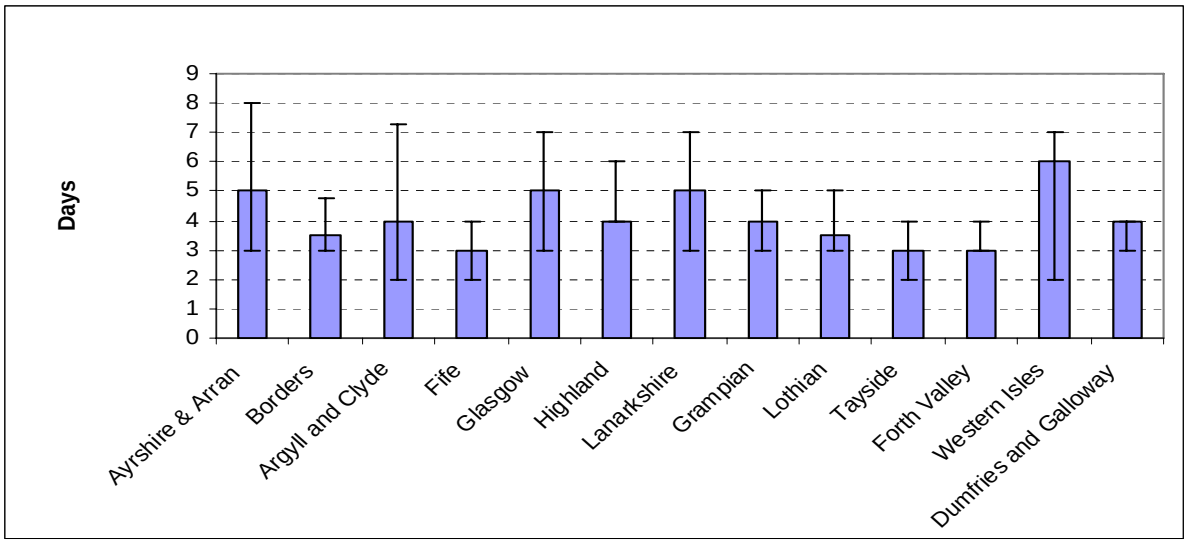
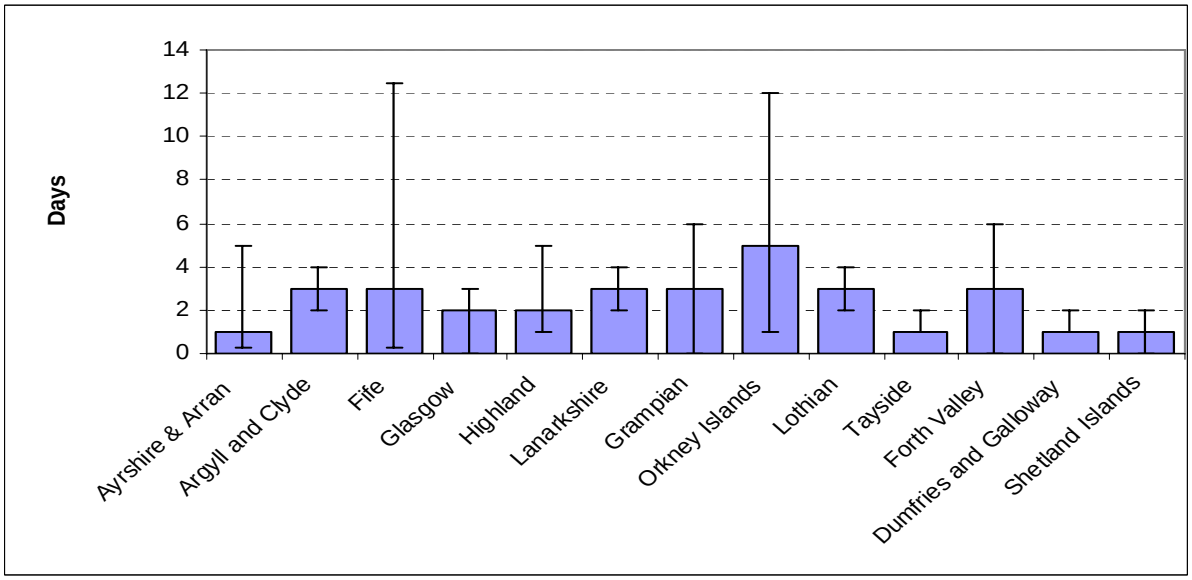


Figure 91 – Median, 25th and 75th percentile of length of stay for Orthopaedic surgeons by Health Board



6.8. Appendix 8 - Consent and confidentiality

Consent

Consent issues for patients and participants have been discussed and opinion has been widely canvassed. The SMR01 dataset is firmly embedded in the administrative structure of NHSScotland and is used for audit and demographic description. It is important that patients are informed of the use of their data in this kind of project. NHS Boards are already providing generic information to patients explaining how their data are used by NHSScotland and their rights with respect to this. As part of the process of improving the information available to patients a poster to inform them about the Scottish Arthroplasty Project has been prepared and is being displayed in orthopaedic departments across Scotland (The poster is available to download from http://www.show.scot.nhs.uk/arthro).

Confidentiality

To date, no identifiable patient data linkable to individual consultant surgeons has been produced or reviewed outside ISD. Only the consultant surgeon concerned has been asked to review these data in order to respect data protection principles (that apply equally to the patient and consultant surgeon). Other than one member of the ISD staff (and then only for administrative purposes), no-one in the project has access to individually identifiable data and therefore cannot comment on or release information on individuals. While this should reassure participants, it also places considerable responsibilities on consultant surgeons to respond to the data supplied. It must be pointed out that the relatively small size of the consultant orthopaedic community in Scotland may occasionally make absolute anonymity difficult.

This confidentiality brings with it responsibility. The Arthroplasty Project under the aegis of the orthopaedic community (SCOT) has developed a process of review to ensure that any results which appear to vary from normal are interpreted at a local level to apply appropriate knowledge and ensure local action. All outlying results are followed up and local review requested (see Section 2.3).

The advent of the Freedom of Information (Scotland) Act 2002 has led us to consider the confidentiality of our processes. A debate is currently taking place about the desirability or otherwise of publishing individual-level surgeons' audit results. While publication of named data seems superficially attractive, and has happened in other branches of surgery, it has neither informed the debate nor the individual patient. We provide all surgeons with their own results which

can be used to inform the consent process. To date we have been successful in providing information which is useful and would inform the decision making process when a patient is considering joint replacement. Individual surgeons results will require local interpretation at the time of interview between patient and surgeon.

Consent is the process of two parties agreeing together. The risks and benefits of surgery are unique to the health, lifestyle and expectations of the patient taken together with the knowledge and experience of the surgeon. We have informed the surgeon of their overall results to use in this process. It would be appropriate if patients ask for these figures during the consent process.

6.9. Appendix 9 – Committee Structure

The Project is overseen by the Scottish Committee for Orthopaedics and Trauma (SCOT), who elect a chair for the Project. The Project is then managed by the Scottish Arthroplasty Steering Committee, whose membership is as follows;

Mr Colin Howie, Orthopaedic Consultant, Chair;
Mr David Allan, Orthopaedic Consultant;
Mr Ian McLean, Orthopaedic Consultant;
Dr David Semple, Anaesthetic Consultant; (Appointed by the Royal College of Anaesthetists Board in Scotland)
Mrs Tracey Rapson, ISD project co-ordinator;
Mr Graham Mitchell, ISD senior programme lead;
Dr Rod Muir, ISD Consultant in Public Health;
Ms Christine Allen, Private hospitals representative;
Ms Angela Donaldson, patient representative; and
representative of the Scottish Association of Medical Directors acting in advisory capacity where necessary.

The orthopaedic consultants sitting on the Steering Committee, including the Committee chair, are nominated by the SCOT Committee and the organisational representative is nominated by the Scottish Association of Trust Medical Directors. The term of office for all nominees is 3 years, with an option to renew this term once. This does not apply to committee members who are not nominated, i.e. ISD staff.

Other health professionals (e.g. nurses, physiotherapists) will be invited to join the steering committee as outcome indicators develop for areas of care to which these professions directly contribute.

The function of the Steering Committee is to plan the medium and long-term strategy of the Project under the direction of SCOT. The Committee also directs the clinical content of the annual report and of any other data analyses produced and manages the clinical governance aspect of the Project.

6.10. Appendix 10 – Staffing

The project is managed on a day-to-day basis by staff at the Information Services Division, which is a division of the NSS. Two whole time equivalents are dedicated to SAP, with input from several other members of ISD staff on a consultative basis. The clinical lead and chair of the project is a consultant orthopaedic surgeon and two further consultant orthopaedic surgeons and an anaesthetic consultant sit on the Steering Committee, which meets three times per year. A member of the public and a representative from the private hospitals sector also contribute by sitting on the Steering Committee.

6.11. Appendix 11 – Action Plan

Scottish Arthroplasty Project:

Action Plan resulting from the identification of data outwith normal variation

Name A N Other

GMC 9999999

Outlier Indicator: dislocations within 365 days following hip arthroplasty Number of hip arthroplasties that you performed: 40 Number of expected dislocations for 40 cases: 1 +/- 2.33 Your value for 40 cases: 5 dislocations, which is greater than the upper control limit of 3.33

Comments concerning quality of information received from Scottish Arthroplasty Project pertaining to cases forming outlying data:

Have corrections been made to SMR01 records at a local level? Y/N Have these corrections been forwarded to ISD? Y/N

Action Plan following review of cases (please continue on separate sheet if necessary).

Signed:

Co-signed:	**GMC Number of Co-signatory**:
Print Name:	
(This signatory must be a GMC registered doctor with whom you have discussed this information and who will confirm what actions have been taken. This colleague may be your medical manager, medical director or a senior colleague and need not be employed within your Trust.)	

6.12 Appendix 12 - References and links

AOA National Joint Replacement Registry Annual report

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