



Optimal patient pathways for hip and knee arthroplasties: Use of Enhanced Recovery After Surgery principles - 2013

A Report from the Musculoskeletal Audit on behalf of the Scottish Government

The information in this report is intended to be used for improvement purposes. The information has been collected by local MSK Audit co-ordinators based in each hospital. These statistics have not been through ISD's official publication process but have been subject to the MSK Audit's own quality assurance process.

We report on a fourth 12-week Enhanced Recovery After Surgery (ERAS) 'snapshot' audit commissioned by the Scottish Government that collected data on hip arthroplasties from **all Scottish operating hospitals** between 1st September to 21st September 2013 and 1st October to 21st October 2013. Data on knee arthroplasties was collected between 1st November to 21st November 2013 and 1st December to 21st December 2013. In the first period we included **all patients** listed for an elective Total Hip Replacement. Revision surgery, hemiarthroplasties and resurfacing surgery were excluded. During the second period we included **all patients** listed for an elective Total Knee Replacement, excluding revisions, resurfacings and unicompartmental knee arthroplasties. MSK Local Audit Co-ordinators collected data from patient case notes, patient information systems, results reporting and referral management systems.

We report the current use of ERAS methods for arthroplasty patients within Scotland's Orthopaedic units, and compare the use of these methods to earlier audits in May to July 2010, April to June 2011 and August to November 2012.

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Summary of Key Findings and Recommendations

It is very encouraging to see the huge progress that has been made across Scotland in the three years that there has been a focus on embedding Enhanced Recovery pathways as the norm. Individual units have developed their own pathways with varying emphasis on different elements to suit their own local situation. Over 90% of all hip and knee arthroplasty patients now benefit from an Enhanced Recovery pathway. The majority of the remaining 10% are treated at four hospitals (Elgin, Inverclyde, Monklands and Wishaw). Lanarkshire introduced elements of goal directed care in the last three years and have recently implemented an Enhanced Recovery programme, starting at Hairmyres and now being rolled out to Monklands and Wishaw. Grampian are in the process of re-invigorating their Enhanced Recovery programme and the benefits are beginning to show in the data in this audit. They also have plans to develop the pathway for patients in Elgin.

The Scottish Government have recently launched the 'MSK and Orthopaedic Quality Drive' with five high priority workstrands. 'Optimising Patient Recovery after Joint Replacement' is one of the five workstrands. See [Quality Drive web link](#) for further details.

Aim of the 'Optimising Patient Recovery after Joint Replacement' workstrand

- By 31st March 2015, all arthroplasty patients across Scotland to have the best practice interventions along their care pathway that enhance their experience and optimise their recovery so that they reach their discharge criteria as soon as possible.
- **Patient Focus** – "If I need a joint replacement I want to be a partner in my care so that I can recover as quickly as possible."

What will success look like?

- A consistent best practice pathway is the norm for all patients in Scotland. Each hospital has a local consensus on the clinical interventions along the pathway that should apply to all joint replacement patients (and where variation from the standard protocol is clinically appropriate that the degree of variation is agreed and followed by all).
- Five days or less is the norm for post-operative length of stay (already achieved for at least 87% of hip and knee replacement patients by the top quartile of hospitals in this audit).
- No outlier hospitals for: Readmissions within 28 days; Wound Infections; Dislocations; and, VTEs.
- Each Orthopaedic Department has a continuous improvement process including testing small cycles of change and measurement of key indicators.

What is the potential impact?

- An improved patient experience with faster recovery. This will be encouraged by reductions in the rates of nausea and vomiting, catheterisation, blood transfusion, post-op IV fluid requirement and VTE complications, accompanied by optimised pain management, early return to normal diet and early mobilisation – Good quality care costs less than sub-optimal care.
- On the basis of a reduction of 0.8 days in the mean length of post-op stay between 2010 and 2013, approximately 11,000 (15%) fewer bed days per annum are being used by Scotland's 13,500 hip and knee arthroplasty patients. If the lower three quartiles of hospitals achieved the same level of post-op stay as the top quartile are currently achieving, this would free up a further 9,000 (14%) bed days per annum. This is one of the key enablers for greater throughput of patients and therefore less need for use of non-core capacity.

What should we do now and what support is available?

- Make full use of national support for this workstrand:
 - This will be the final full audit for Enhanced Recovery. As part of the Quality Drive the MSK Audit team are now auditing each of the four pathway workstrands on a rolling basis of one week per workstrand throughout 2014 to ensure momentum and focus on improvement opportunities. Results from each cycle will be available within three weeks of the end of collection to allow implementation of improvement cycles 'closing the loop on action'. The Rolling Audit is measuring the items in the table below. If you have not yet seen this Rolling Audit data then contact Kate.James@scotland.gsi.gov.uk to get on the distribution list.
 - In parallel, as part of the Scottish Government's overall focus on Enhanced Recovery across a number of specialties, Boards are encouraged to use QuEST support to achieve local real-time measurement of key indicators so that this is in place when the Rolling Audit finishes.

Enhanced Recovery Programmes should be delivered by multidisciplinary teams and be multimodal in nature with the aim of optimising every step of the patient pathway (Wainwright and Middleton, 2010). This audit has measured the variables considered by the ERAS Orthopaedic Steering Group to be of most relevance.

A number of case studies from hospitals across Scotland have been included in the Appendices that explain how particular units have embedded an improvement that has resulted in an above average achievement for particular interventions along the pathway.

National Achievement in Three Years and Aim by March 2015

	2010	2013	Aim by March 2015
Patients managed as ERAS patients	21%	92%	All patients
Pre-Admission Written Information Given	96%	92%	All patients
Same Day Admission	29%	55%	Increase to benefit patients
Effective pre-op Assessment to minimise cancellations on day of surgery (e.g. full anaesthetic involvement)	-	-	No outlier hospitals for cancelling unfit patients
Fasting Prior to Op >10 hrs	49%	69%	No patient scheduled for p.m. list
Oral Fluids Withheld Prior to Op >4 hrs	50%	53%	No patients
Pre-op Urinary Catheterisation	3.8%	0.4%	Not routine & no outlier hospitals
Restarting diet on day of surgery or <12 hrs post-op	60%	88%	All patients by midday Day 1 Post-op
Mobilisation of patients by end first day post-op	84%	95%	All patients by midday Day 1 Post-op
IV fluids stopped on day of surgery or <12 hrs post-op	22%	70%	All patients by midday Day 1 Post-op
Use of PCAs	49%	14%	Not routine
Mean post-op length of stay (days)	5.6	4.8	
Patients discharged by 3 days post-op	21%	36%	5 days or less for 85% of patients
Patients discharged by 5 days post-op	62%	75%	
% Re-admitted within 28 days of surgery	-	4%	No outlier hospitals
Wound Infections, Dislocations and VTEs	-	-	No outlier hospitals *

- Monitored via the Scottish Arthroplasty Project

The audit also looked at relationships between variables, both across hospitals and within hospitals. It is interesting to note that although relationships were often found *across* hospitals (e.g. hospitals with lower use of PCA had higher same day mobilisation rates), there was no clear relationship *within* hospitals (i.e. early mobilisation rates were not necessarily higher in patients who had not used PCA morphine, compared to those patients in the same hospital who did use PCA morphine). Although this audit was neither designed nor powered to rigorously test such relationships, this finding is interesting, suggesting perhaps that the benefits of ERAS may be more closely related to the use of ERAS principles as a whole in each hospital rather than specific elements of care, and that the combined ERAS initiative may itself be even more effective than the sum of its individual parts.

Patient Demographics and Medical History –

- A number of metrics were measured (age, ASA, BMI, co-morbidities, deprivation, pre-operative haemoglobin and creatinine – see Figs. 1 to 8) and have remained largely unchanged between audits. Pre-existing use of opiate analgesia has been added in this audit and shows a variation between hospitals.
- It is encouraging to see little evidence of ‘cherry-picking’ of patients for ERAS programmes: all patients (including more complex patients) can benefit from an ERAS pathway.

- The metrics measured allow hospitals to benchmark for demographic and case-mix related factors. Clinicians are encouraged not to dwell on whether their hospital has more 'complex' patients than elsewhere. Variation in casemix factors appears neither consistent nor extreme.

Pre-op Education –

- Most patients (over 90%) receive information in a variety of different formats around the country (see Figs. 10a & b). The ERAS steering group provided funding to develop a national patient information booklet template that is available to all boards to customise.

Same Day Admission, Fasting, Fluids and Pre-medication –

- The increase in same day admissions impacts on anaesthetic practice such as periods of fasting and fluid restriction and use of pre-medication. Overcoming these challenges will ensure a more efficient service whilst maintaining key ERAS principles.
- Not having to stay in hospital pre-operatively is also seen as a patient quality and satisfaction benefit and therefore integral to an ERAS pathway.
- There has been no improvement in fasting and restriction of oral fluid times across the units since 2010, with longer times for patients admitted on day of surgery (see Figs. 12 & 13). This may be due to inadequate fasting advice given to patients who are admitted on the day of surgery, or that it is not properly followed. Reducing lengthy fasting and withholding of fluids is the biggest remaining significant challenge for Enhanced Recovery Improvement teams across Scotland.
- Only 55% of patients received pre-operative medication (see Figs. 14 & 15) and the percentage was even lower for patients admitted on the day of surgery.
- Units are encouraged to review patient education and logistic challenges associated with same day admission.

VTE Prophylaxis –

- It appears there is little consensus in what constitutes best practice (see Fig. 16). The Scottish Committee of Orthopaedics and Trauma (SCOT) are currently drafting guidelines that will be ratified by SCOT and then distributed to Boards.

Antibiotic Prophylaxis -

- Boards are encouraged to review the recommendations made by the Scottish Antimicrobial Prescribing Group (SAPG) in July 2012 (see Fig. 17 and associated text).

Anaesthesia and Analgesia –

- Each unit will have its own preferences, but whichever methods are chosen, they should enable safe and early mobilisation of patients with an early return to normal function. It is encouraging to see the intra-unit standardisation over the past three years, with the associated benefits for monitoring the effects of the local regimen on outcomes and the support of a consistent approach in wards of treating all patients the same.
- The majority of patients in Scotland receive regional anaesthesia, predominantly spinal anaesthesia plus either local wound infiltration or peripheral nerve blockade. Over the three years of this audit there has been a significant shift away from regional nerve blocks to Local Infiltration Analgesia (LIA) for both hip and knee arthroplasty (53% of patients now receive LIA compared with 17% in 2010 – see Fig. 18).
- See Fig. 19 and associated text for use of intrathecal opioids and analysis of the impact on post-operative outcomes with specific reference to post-operative urinary catheterisation.
- There has been a clear shift away from IV opioids for both hip and knee arthroplasty (Figs. 26 & 27). LIA continues to grow in popularity with 50% of hip patients and 55% of knee patients receiving it as the primary method of post-operative analgesia with a corresponding reduction in regional nerve blockades. Debate continues over the most effective post-operative analgesic regimen and with recent developments in distal nerve blockade and a myriad of different LIA cocktails described within the literature, maybe now is the time to look at multi-centre trials around Scotland to further improve pain management and return to normal function for patients.

Post-operative Nausea and Vomiting –

- PONV is a major cause of patient dissatisfaction and may prevent early mobilisation. Units are encouraged to review their rates and documentation protocol further (see Figs. 29 & 30).
- Full analysis of the PONV data is difficult due to the nature of the quantitative versus qualitative scoring and the timing of administration of anti-emetics (see Fig. 31). Use of Ad-hoc Anti-emetics has been added to this audit (see Fig. 31c).

Post-Discharge Physio –

- There has been very little change over the three years in the rates of patients being referred for outpatient physiotherapy on discharge (see Fig. 33). With the continual demand on MSK services, and the target of only 4 weeks wait for outpatient therapy by 2016, it is imperative that the need for outpatient therapy is reviewed and consideration given to how we best use a finite resource. Interestingly a number of internet based rehabilitation programmes, with patients encouraged to follow exercise programmes, have been shown to be as effective as outpatient therapy.

Patient experience –

- Although several sites are routinely collecting Patient Reported Outcome Measures (PROMS) and patient satisfaction information, it is disappointing to see that many are not collecting anything at all (see Fig. 34). Use of PROMS and patient experience information is an extremely important element of continuous improvement.

Delay to Discharge –

- New for this audit are figures showing reasons for delay for patients not discharged by Day 5 and Day 7 post-op. It is reassuring to see that administrative reasons (e.g. delay in social services provision of requirements) does not feature particularly frequently (see Figs. 37a & 37b).

Renal function –

- A common area of concern regarding the use of ERAS principles has been post-operative renal function. Of those patients who had normal eGFR (> 60) pre-op, 11% became abnormal (<=60) post-op (Figs. 39 & 40).

Re-admissions within 28 days –

- It is encouraging to see a low rate of readmission across the majority of sites (Fig. 41). It is important for the on-going support of ERAS pathways by patients and all NHS staff that no statistically significant relationship was found between the units' re-admission rates and the percentage of patients that the unit managed as ERAS patients, or the units' mean post-operative length of stay.

It is clear that there has been considerable change in patient pathways for arthroplasty across Scotland over the last three years. This change has been achieved by teams reviewing local care pathways and clinical evidence and sharing practice around Scotland.

We encourage each board to utilise the report to further enhance their local programme. If you wish more data on your own patients included in the audit, including analysis by anaesthetist or surgeon, or if you wish a visit to discuss the report in more detail please contact

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The ERAS Orthopaedic Steering Group 2014

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Number of patients

Throughout this report data are presented by the hospital where the patient's surgery was undertaken. Table 1 provides details of the number of included and excluded patient per site. Further in-depth detail of exclusions is provided in the footnotes below. As far as we are aware, the majority of arthroplasty patients that had surgery in each hospital were audited and included in this report, except for those hospitals specified in Table 1. Otherwise, exclusions are believed to be random in nature and not biased towards any category of patient.

Table 1: Number of patients reported on

Hospital	Number of primary arthroplasty patients included in this report			Number (%) excluded
	Hips	Knees	Total	
Ayr	21	24	45	2 (4%) ^a
Crosshouse	23	33	56	0 (0%)
BGH	17	24	41	0 (0%)
DGRI	18	28	46	0 (0%)
Fife	49	61	110	1 (1%) ^a
Forth Valley	15	26	41	0 (0%)
Aberdeen	41	37	78	9 (10%) ^a
Elgin	22	17	39	0 (0%)
GRI	16	43	59	NA
WIG	20	49	69	NA
Victoria	11	14	25	4 (14%) ^a
SGH	23	29	52	0 (0%)
RAH	28	36	64	6 (9%) ^b
Inverclyde	22	20	42	0 (0%)
GJNH	116	162	278	2 (1%) ^a
Raigmore	41	39	80	0 (0%)
Hairmyres	21	44	65	0 (0%)
Monklands	17	23	40	0 (0%)
Wishaw	16	15	31	0 (0%)
RIE	72	79	151	1 (1%) ^a
Ninewells/Stra	54	53	107	0 (0%) ^c
Perth	36	38	74	0 (0%)
Total	699	894	1593	25 (2%)

- NA= Data not available.
- The audit included elective hip arthroplasty patients operated on between 1st and 21st September 2013 and between 1st October and 21st October 2013, and elective knee arthroplasty patients operated on between 1st November and 21st November 2013 and between 1st December and 21st December 2013.
- To boost sample sizes, some sites with small numbers included additional hips in November (Wishaw n=5, Elgin 1, Inverclyde 8, WIG 1) and additional knees from 22nd-31st of November/December or in September (Elgin n=6, Inverclyde 2, Wishaw 6).
- ^a Exclusions due to lack of access to casenotes, usually when these were held in offsite units.
- ^b Exclusions due to staff leave.
- ^c Stracathro patients only include those who were Tayside patients. Grampian patients treated in Stracathro were not audited.

Methodology and Use of Statistics

Although hip and knee arthroplasties are very different operations, some aspects of the management of these patients are often very similar. In the interests of brevity of this report we have combined figures for hip and knee operations for variables where there was little meaningful difference between these types of operations nationally. Otherwise they are reported separately.

Selected statistics comparing management and outcome variables are given throughout this report. However, as individual hospital policies have the potential to affect *all* of a hospital's patients, we took each of the 22 contributing hospitals as a statistical unit rather than individual patients across Scotland. We then mainly report on whether there are relationships between the percentages of patients managed in a particular way in a hospital against outcomes (e.g. use of PCA versus early mobilisation). However, further breakdown of the data often showed that although there may be a relationship *across* hospitals (e.g. hospitals with lower use of PCA had higher same day mobilisation rates), there was no clear relationship *within* hospitals (i.e. early mobilisation rates were not necessarily higher in patients who had not used PCA morphine, compared to those patients in the same hospital who did use PCA morphine). Although this audit was neither designed or powered to rigorously test such relationships, this finding is interesting, suggesting perhaps that the benefits of ERAS may be more closely related to the use of ERAS principles as a whole in each hospital rather than specific elements of care, and that the combined ERAS initiative may itself be even more effective than the sum of its individual parts.

Demographics and Medical History

The 'typical' arthroplasty patient in Scotland has remained fairly consistent over the past three years: 80% of patients are over 60 years old, with an average age of 68 and an ASA score of either 1 or 2 (77%) (Figs.1 & 2). Only 13% of arthroplasty patients were of normal BMI; 34% were classed as overweight and 52% as obese (Fig. 3). This is representative of the overall Scottish population (Scottish Government, 2009) and is a growing issue to consider when planning joint arthroplasty. Deprivation varies widely between units, reflecting the differences in catchment populations served (Fig. 4).

As in 2012, 36% of patients had significant co-morbidities. These included 7% who had chronic kidney disease, and 4% who had Inflammatory Joint Disease. Pre-operative serum creatinine and haemoglobin levels were also collected (Figs. 6 & 7).

Figs. 1-8 allow hospitals to benchmark for demographic and case-mix related factors. Although some hospitals appear towards the end of the spectrum on these graphs more than once, variation does not appear consistent or extreme. Clinicians are encouraged not to dwell on whether their hospital has more 'complex' patients than elsewhere.

All hospitals with well-established ERAS programmes treat all patients as Enhanced Recovery rather than 'cherry-picking' as they believe all patients can benefit from the interventions along the pathway.

Fig. 1: Age

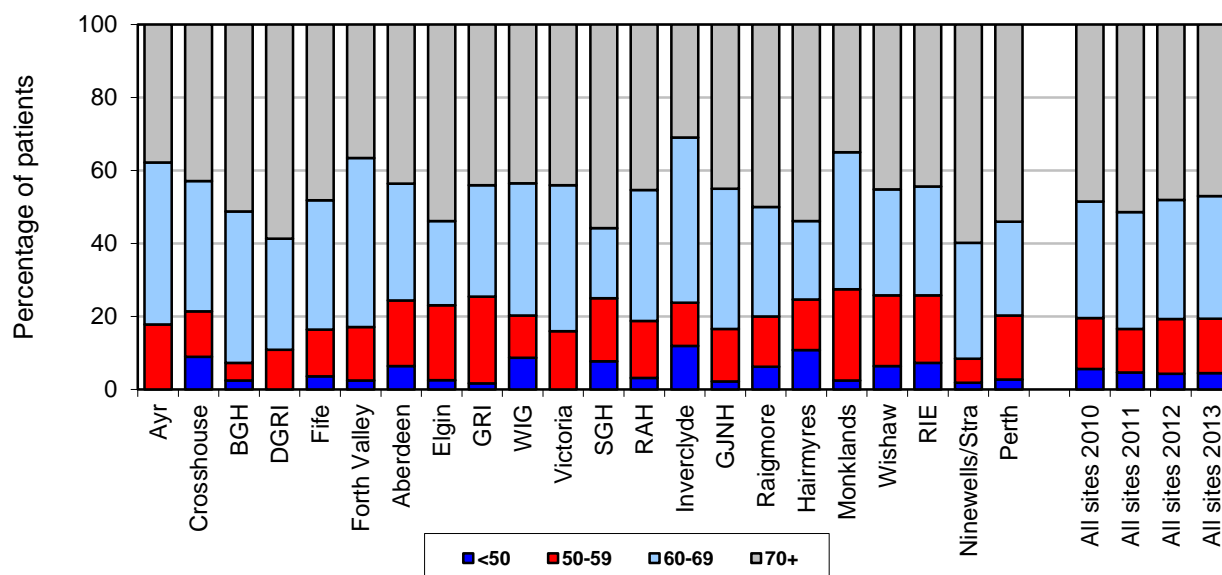


Fig. 2: ASA

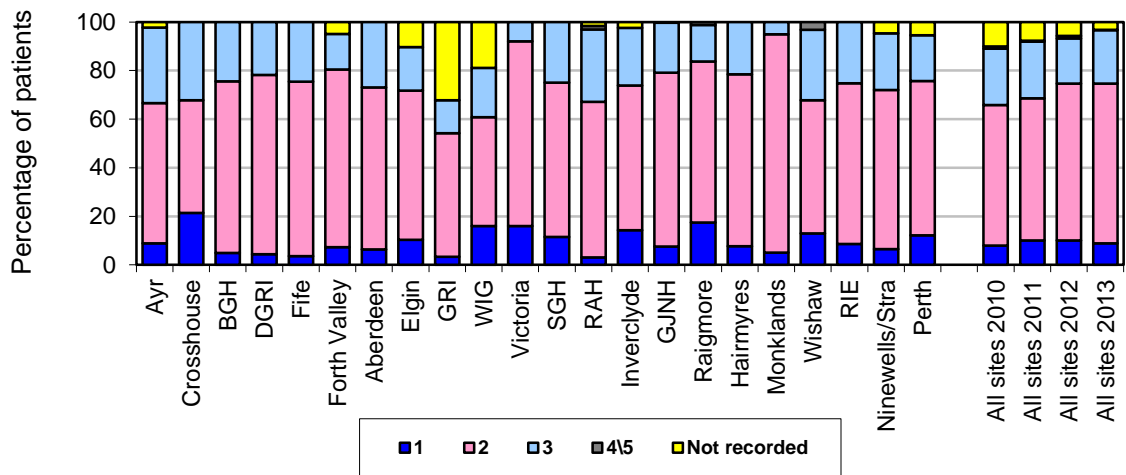


Fig. 3: BMI

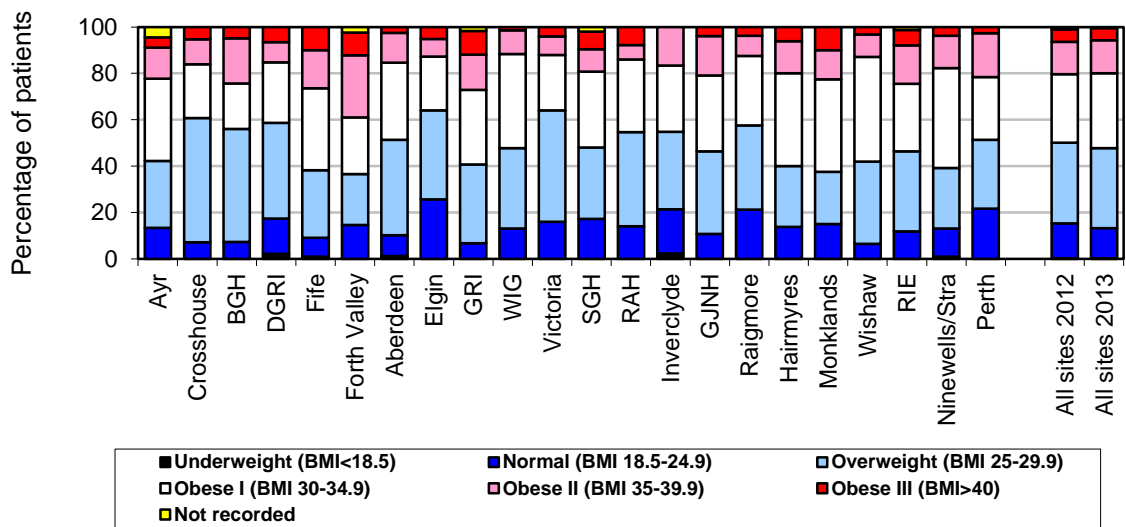
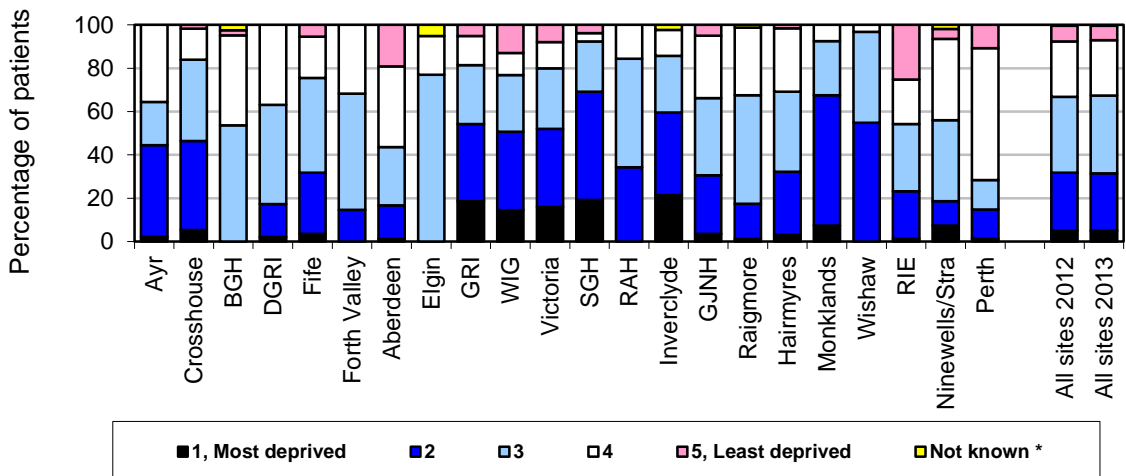
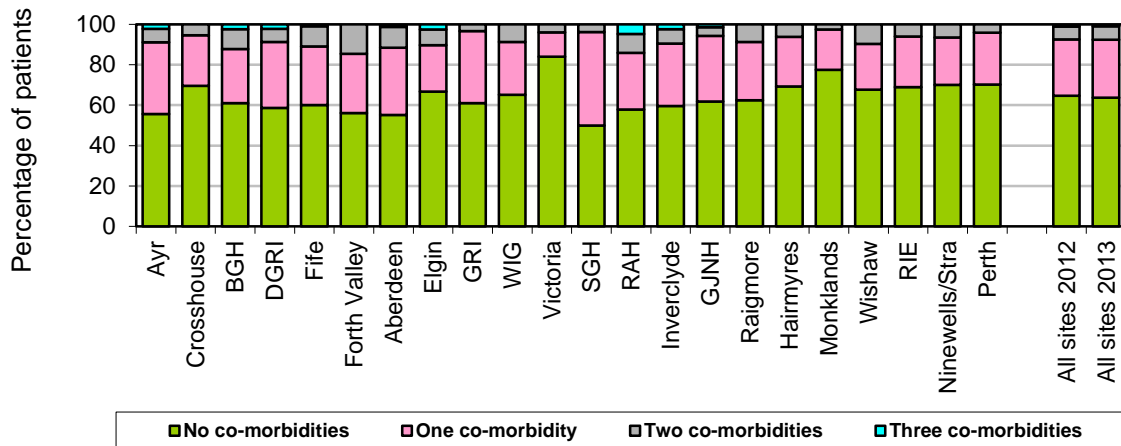


Fig. 4: Deprivation



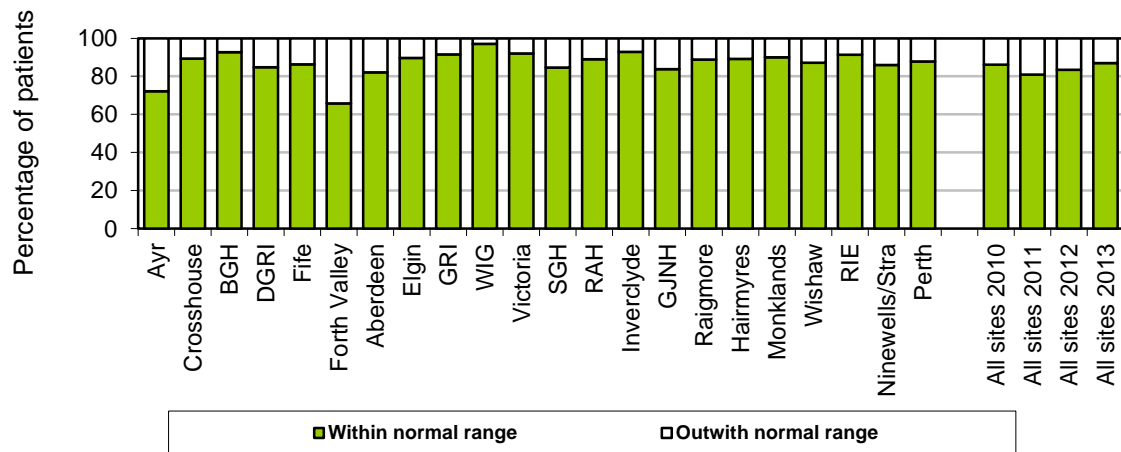
To ensure patient confidentiality during data processing, the MSK Audit only collects each patient's postal district data rather than full postcode (i.e. first 5 characters of postcode such as 'MK 15 6'). This precludes direct matching of the postcode data to the Scottish Index of Multiple Deprivation (SIMD) population-weighted deprivation quintiles data. However, the postal district data has been matched to the average deprivation value for all full postcodes in the district in SIMD, giving a comparable (but less precise) deprivation score, and this is what is presented in Fig. 4. Because an average deprivation figure is used for each postal district, data for fewer patients will be extreme, hence the non-equal distribution of 'quintiles' across Scotland (end bar). However, the size of these derived quintiles was significantly positively related to the proportion of patients in each SIMD quintile in each hospital across Scotland.
 * 'Not known' includes patients whose postcode did not match directly to a deprivation quintile.

Fig. 5: Medical history - number of previous selected co-morbidities



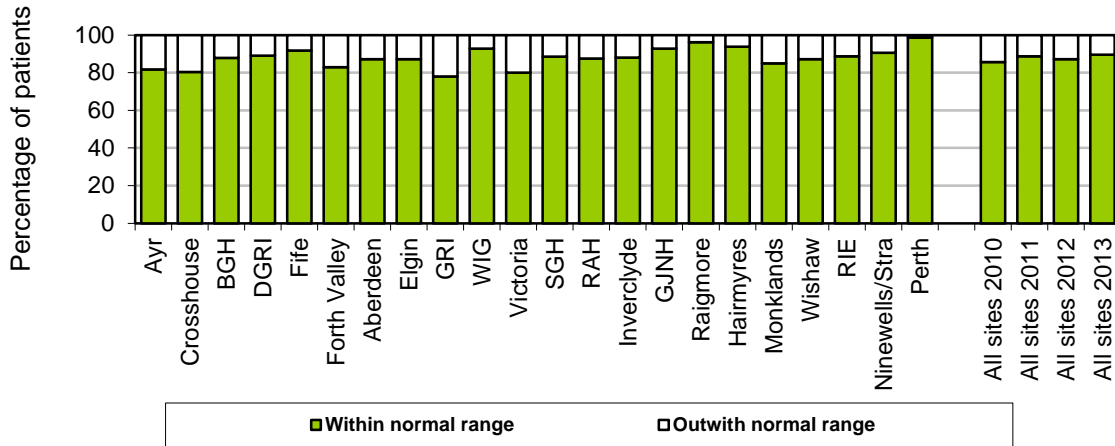
This information was found in the patients' medical clerking, pre-assessment or anaesthetic assessment sheets irrespective of time since diagnosis. In addition to the set of six co-morbidities we measured in previous years (IDDM, ischaemic heart disease, CVA/TIA, pulmonary embolism, LVF/CCF or COPD) since 2012 we also specifically recorded neuromuscular disorders and, inflammatory joint disease, and any 'Other' significant medical conditions (e.g. chronic kidney disease, AF, previous/current malignancies) relevant to the patient's care. 'Other' conditions were not originally individualised during data collation, and although validated as a relevant serious co-morbidity, were collectively included as one co-morbidity.

Fig. 6: Pre-operative serum creatinine



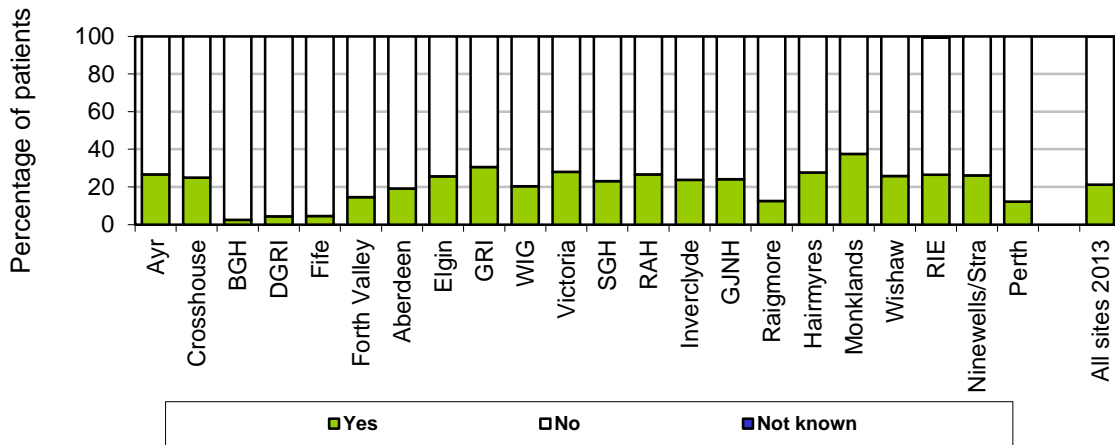
In 2012 and 2013 we recorded absolute pre-operative serum creatinine level and defined levels of 44-90 for females and 60-110 for males as 'normal' levels. In contrast, in previous years 'normal' levels were taken as those defined as 'normal' by each unit and so may have differed to an unknown extent from the 2012/13 definition.

Fig. 7: Pre-operative haemoglobin



In 2012 and 2013 we recorded absolute pre-operative haemoglobin level and defined levels of 115-165 for females and 130-180 for males as 'normal' levels. In contrast, in previous years 'normal' levels were taken as those defined as 'normal' by each unit and so may have differed to an unknown extent from the 2012/13 definition.

Fig. 8: Patient on pre-existing opiate analgesia

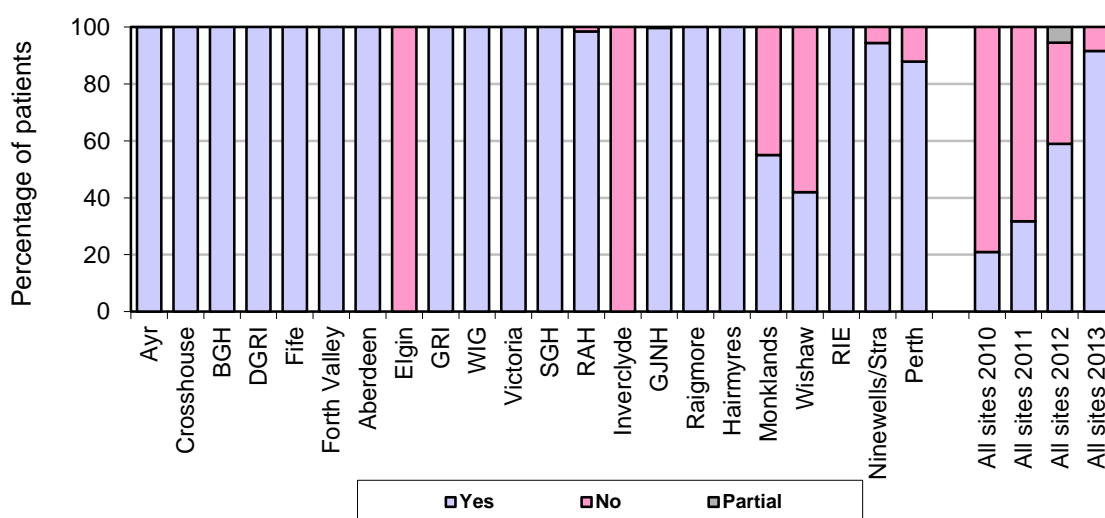


Enhanced Recovery After Surgery Programmes

Enhanced Recovery Programmes should be delivered by multidisciplinary teams and be multimodal in nature with the aim of optimising every step of the patient pathway, resulting in accelerated post-operative recovery and a reduction in general post-operative morbidity (Wainwright & Middleton 2010). Some units use other terms such as 'fast-track' or 'rapid recovery'. These relate to the ERAS ethos and therefore within this audit have been counted as such.

There is no clear definition in literature of what an ERAS pathway encompasses, however Kehlet (2009) describes some generic principles summarising the important areas, but stresses these must be procedure specific. Previous MSK ERAS reports have identified three important components as patient education, a standardised multimodal analgesic regimen and early mobilisation. This is assisted by reducing urinary catheterisation and blood transfusions unless clinically necessary, early removal of IV fluids, and an early return to diet. It is clear that there has been considerable change in patient pathways for arthroplasty across Scotland over the last four years. This change has been achieved by teams reviewing local care pathways and clinical evidence and sharing practice around Scotland.

Fig. 9: Was the patient treated as an Enhanced Recovery patient?



It is very encouraging to see the huge progress that has been made across Scotland in the three years that there has been a focus on embedding Enhanced Recovery pathways as the norm. Individual units have developed their own pathways with varying emphasis on different elements to suit their own local situation. Over 90% of all hip and knee arthroplasty patients now benefit from an Enhanced Recovery pathway. The majority of the remaining 10% are treated at four hospitals (Elgin, Inverclyde, Monklands and Wishaw). Lanarkshire introduced elements of goal directed care in the last three years and have recently implemented an Enhanced Recovery programme, starting at Hairmyres and now being rolled out to Monklands and Wishaw. Grampian are in the process of re-invigorating their Enhanced Recovery programme and the benefits are beginning to show in the data in this audit. They also have plans to develop the pathway for patients in Elgin.

Multidisciplinary teams across Scotland should continue their excellent work to develop their local programme fit for their own local situation. Units are encouraged to collect data locally to further improve their own programmes with the associated benefits for patients.

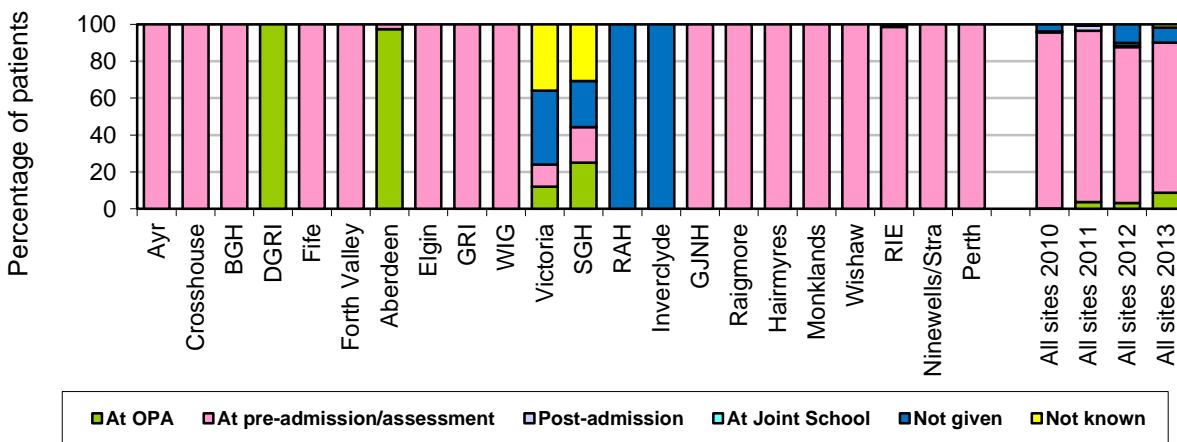
Pre-operative phase

Clinical Contact and Information Provided to Patient

Providing patients with clear information and therefore clarifying their expectations prior to surgery is not a new concept. It has been shown in numerous studies to alleviate anxiety and some suggest it may improve outcomes (Mancuso *et al.* 2001, McDonald *et al.* 2004). Previous MSk Audit work has shown an association between provision of education and reduced length of stay (Scott *et al.* 2013). Joint schools, patient booklets, DVDs, or web-based sources of information are growing in popularity.

Developing written materials is time consuming. The materials require regular review to ensure they remain up to date. The ERAS steering group provided funding to develop a national patient information booklet template that is available to all boards to use as they wish. It is hoped that clinical teams will customise the template booklet with specific local information that can be published at a marginal cost, providing patients with a useful bespoke guide containing clear information prior to attending for surgery.

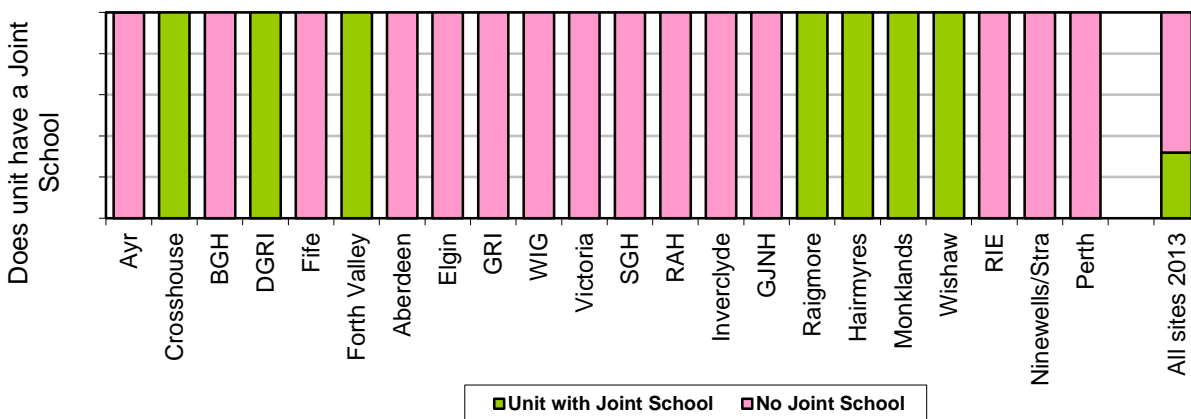
Fig. 10: Planned pathway: First written information given



Note that in 2010 and 2011 if the patient attended a hip/knee 'school' this was recorded as pre-admission/ assessment, whereas in 2012 and 2013 we recorded this information separately.

*Ninewells – Written information of planned pathway given as a leaflet sent out with admission information pack.

Fig. 10b: Which units have Joint Schools?

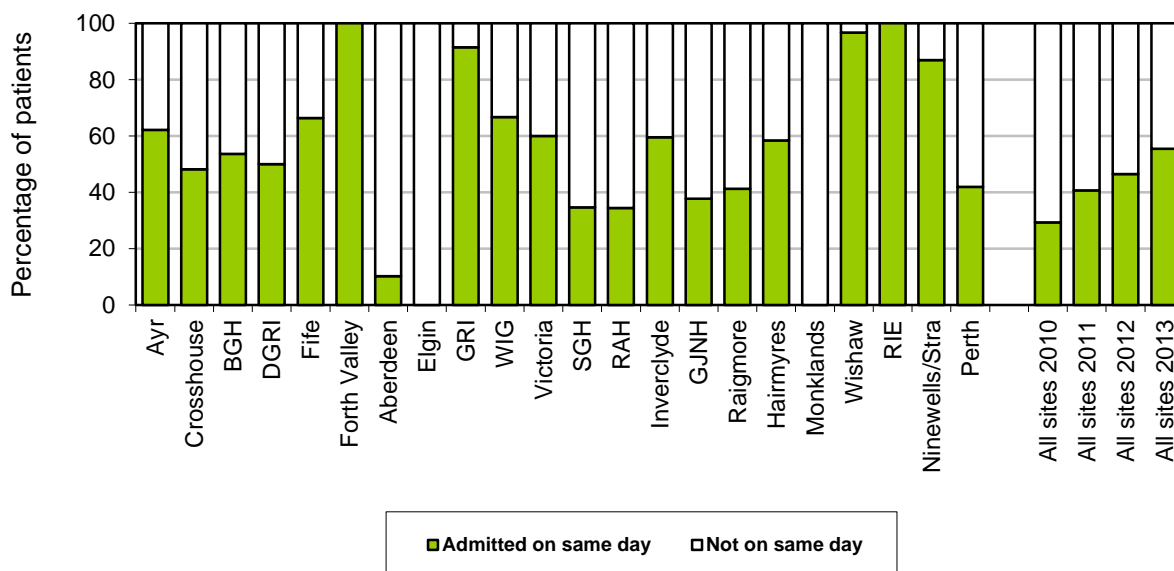


Admission to hospital

Same day admission of patients is increasing across Scotland. It does, however, have some impact on anaesthetic practices such as fasting and fluid restriction and use of pre-medication. Overcoming these challenges will ensure a more efficient service whilst maintaining key ERAS principles. Not having to stay in hospital pre-operatively is also increasingly being seen as a patient quality and satisfaction benefit and therefore is integral to an ERAS pathway.

Across Scotland there has been a further increase in the number of patients admitted on the day of surgery with 55% of patients now compared to 41% in 2011 and only 29% in 2010 (Fig. 11).

Fig. 11: Patient admitted on day of surgery



Fasting and Fluids

Reducing lengthy fasting and withholding of fluids is the biggest remaining significant challenge for Enhanced Recovery Improvement teams across Scotland. The percentage of patients fasted for 10 hours or more has increased rather than decreased over the past four years and lengthy withholding of fluids has remained static.

The guidelines from the Royal College of Anaesthetists suggest that patients should be allowed to eat up to 6 hours prior to surgery and may drink clear oral fluids until 2 hours pre-operatively. Our figures show that nationally there has been no improvement in fasting times or in restriction of oral fluids across the units since 2010 (Figs. 12 & 13). This may be because of the increase in same-day admission for surgery (Fig. 11) with patients still instructed to fast overnight. 76% of same day admissions had been fasting more than ten hours compared to 60% of previous day admissions. Only nine percent of same day admissions were given instructions to take clear oral fluids until two hours before surgery compared to 17% of previous day admissions.

In some units there are fasting policies in place that encompass the guidelines noted above, but frequently the unit protocol is not followed by clinical staff or by the patients themselves. The fasting information provided to patients, particularly those that are 'same-day admissions', varies in quality. Education of patients regarding the avoidance of prolonged fasting should be included in the pre-operative information provided.

Although carbohydrate loading has become a major component of ERAS pathways in other surgical specialities it has not been transferred to Orthopaedics with only three sites in Scotland routinely using it. There is, as yet, little evidence available to support the widespread adoption of preloading patients with carbohydrates (Harsten *et al.*, 2012). However, as the issue of prolonged fasting has proven difficult to resolve, carbohydrate loading may be worth further consideration.

Fig. 12: Period of fasting

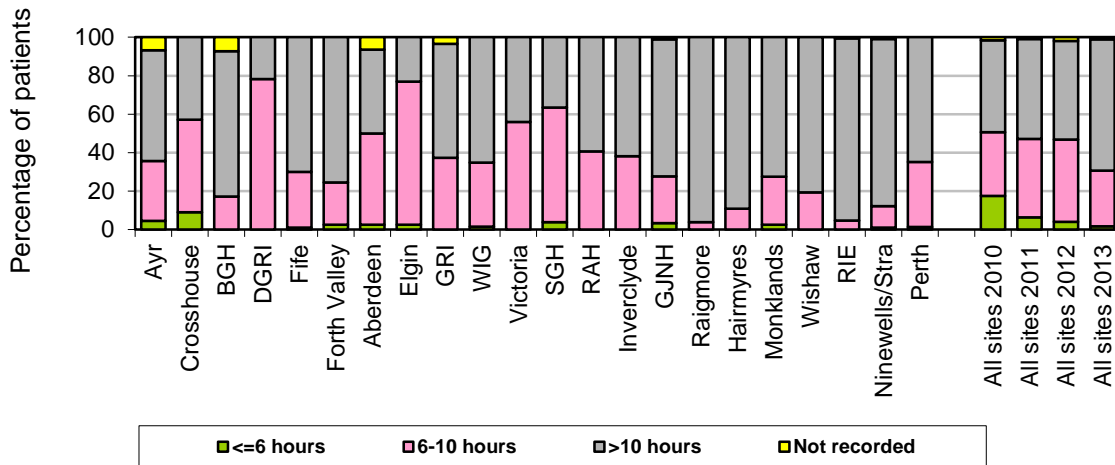
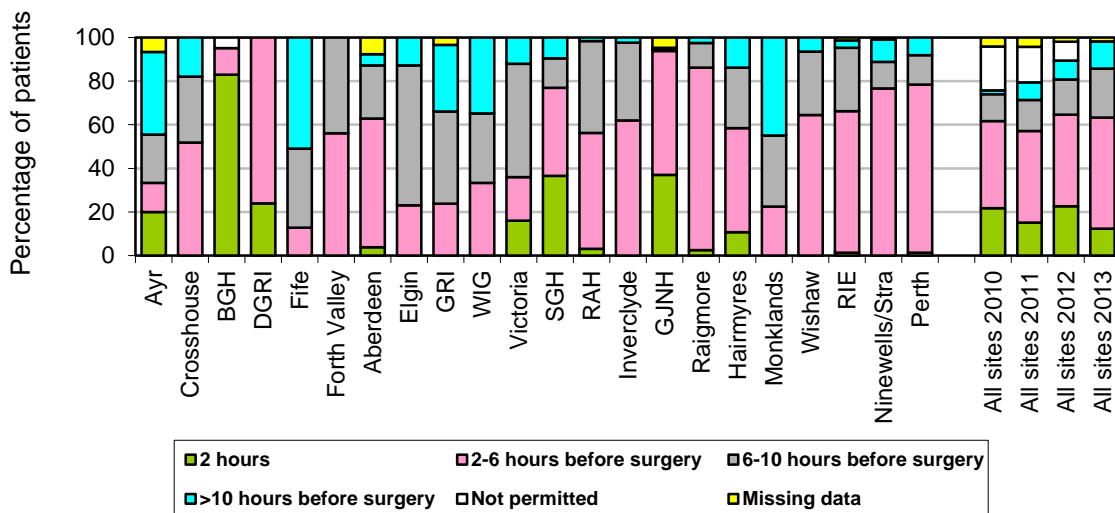


Fig. 13: When were clear oral fluids stopped prior to surgery?



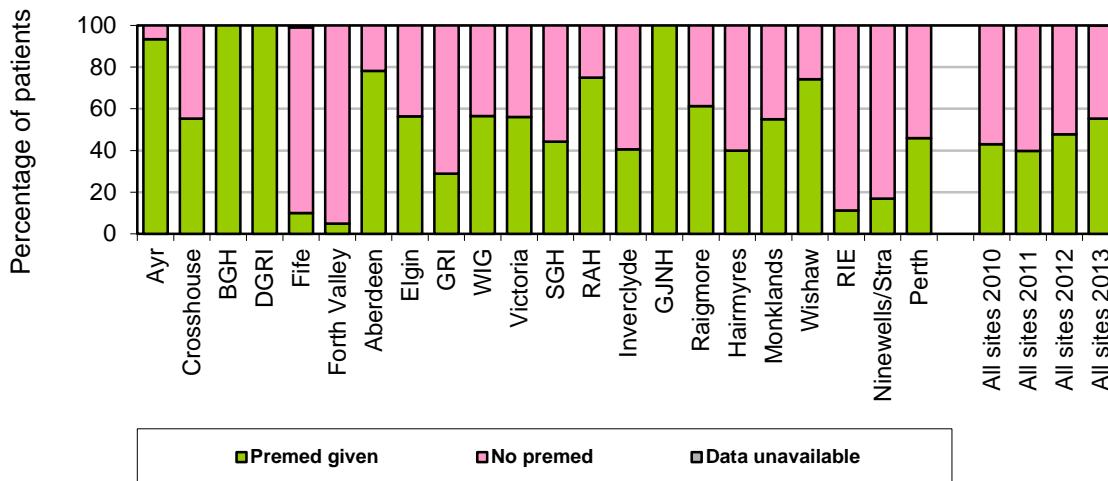
In some units there was a lack of clear documentation to the exact timing of oral fluids being stopped. Please note that if the patient was given carbohydrate loading, it will be included in this section. Note that Hairmyres, Monklands, Wishaw Enhanced Recovery programmes are relatively new. There is some evidence from the first two cycles of the Rolling Audit for weeks in January and February 2014 that Fasting and Fluid times have improved in Monklands and Aberdeen since the data in this full audit was collected. It is important that these improvements are sustained.

See Appendix A to read a Case Study of how one hospital achieved success in reducing the time that clear oral fluids are withheld.

Pre-medication

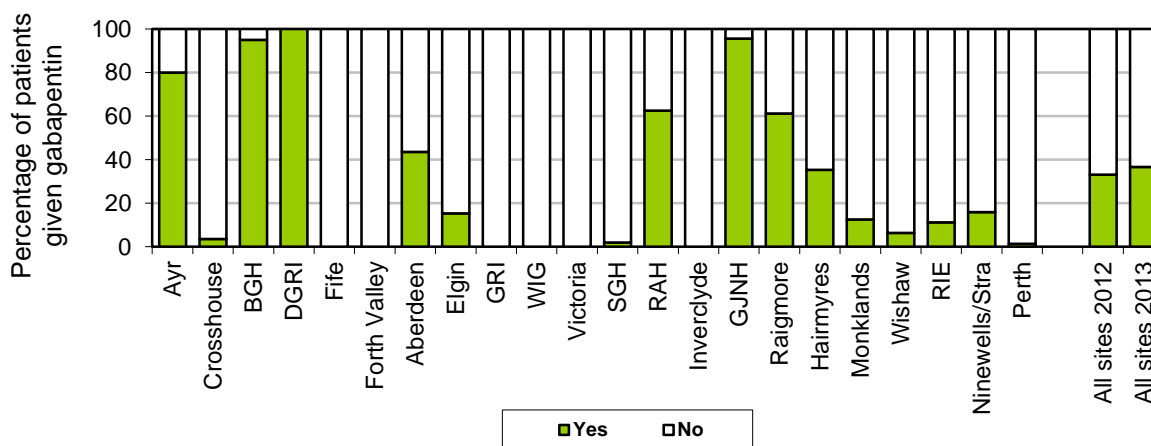
Multimodal analgesic regimens should ideally be commenced pre-operatively. This is not 'pre-emptive analgesia', but ensures good analgesia immediately following cessation of anaesthesia. Only 55% of patients received pre-operative medication (Fig. 14). 42% of patients who were admitted on the day of surgery were given pre-medication, compared to 72% of those who were admitted on the day before surgery.

Fig. 14: Was pre-medication given?



Note that gabapentin is included above as a pre-med, but is also shown separately on Fig. 15.

Fig. 15: Gabapentin given

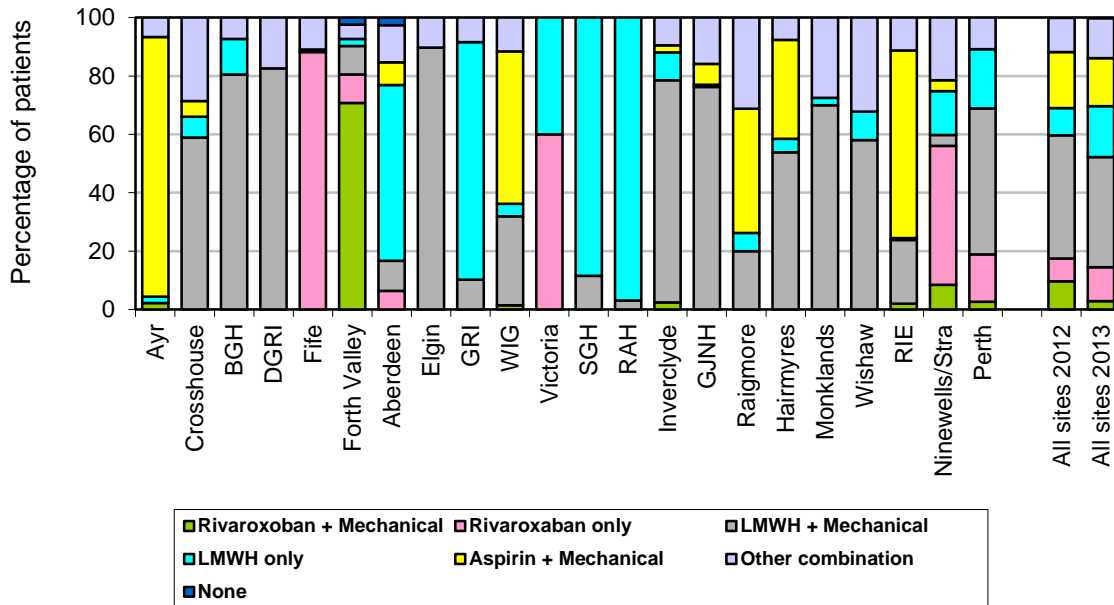


Gabapentinoids reduce post-operative pain and analgesic requirements in patients undergoing arthroplasty and many units now consider them a useful adjunct as part of a multimodal analgesic regimen (Fig. 15). However, although gabapentinoids appear to be better tolerated when used for post-operative pain than for chronic pain, there is an absence of conclusive robust evidence advising the timing and dosage of gabapentinoids for arthroplasty patients (Ho *et al.*, 2006). It should be noted that gabapentinoids have a side-effect profile which includes somnolence and dizziness. These side effects are usually mild, but occasionally can be severe enough to hinder post-operative mobilisation and physiotherapy. Additionally neither the analgesia nor side-effects seen with gabapentinoids appear to be clearly dose-related, and some dose-adjustment may be required to find the optimum balance of analgesia with side-effects.

VTE prophylactic treatment

It is clear that there is no VTE prophylaxis consensus between units (Fig. 16). VTE prophylaxis remains a contentious issue both in Scotland and further afield. The Scottish Committee of Orthopaedics and Trauma (SCOT) are currently drafting guidelines that will be ratified by SCOT and then distributed to Boards. It may be interesting in the future to consider the impact of certain agents on post-operative recovery times and outcomes in a large scale national project.

Fig. 16: DVT prophylactic treatment



Although some patients are prescribed one form of VTE prophylaxis as an inpatient, this may change to another form on discharge e.g. LMWH as inpatient, rivaroxaban only on discharge. The audit recorded what was administered as an inpatient only.

Mechanical = TED stockings, AV impulse boots

Some local orthopaedic units have adopted and follow the most up to date ACCP guidelines on prevention of VTE (Guyatt et al., 2012), which have superseded SIGN 122. Aspirin has been given the same level of evidence (1b) compared to more potent anticoagulation and should be considered first choice on low risk patients when balancing VTE risk versus risk of bleeding and infection (PJI). An individual risk assessment is considered mandatory.

Antibiotic treatment

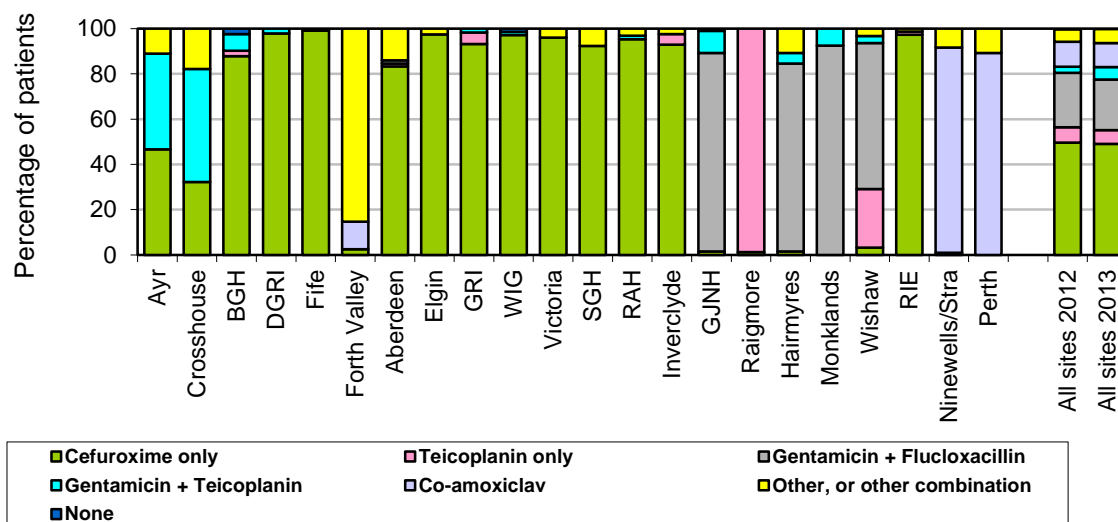
In July 2008, in response to increasing levels of *Clostridium difficile* infection (CDI) in Scotland, the Scottish Antimicrobial Prescribing Group (SAPG) issued guidance to NHS Boards advising use of flucloxacillin plus gentamicin. In 2011 several NHS Boards reported clusters of cases of Acute Kidney Injury (AKI). In response, SAPG funded a robust study to determine whether post-operative renal impairment was an unintended consequence of the introduction of flucloxacillin plus gentamicin prophylaxis in orthopaedic implant surgery. This study was a time series analysis before and after the change in antibiotic regimen of NHS Tayside data from over 8000 patients.

The results from this analysis did identify a link between AKI and use of flucloxacillin plus gentamicin in Orthopaedic surgery, and SAPG issued the following statement in July 2012 -

'In NHS Boards where flucloxacillin plus gentamicin is currently used for orthopaedic surgical prophylaxis, Antimicrobial Management Teams should collaborate with orthopaedic colleagues to consider and discuss implementation of an alternative regimen. The choice of agent should be agreed at local level based on a risk benefit analysis to consider potential adverse consequences such as SSI, CDI and AKI. The potential for emerging resistance to alternative agents and the role of local pre-, intra- and post-operative factors should also be considered. If a Board wishes to continue using flucloxacillin plus gentamicin, in the light of this data, there is a requirement to have local systems in place for monitoring potential adverse effects, particularly renal toxicity. In relation to CDI although rates have reduced throughout NHS Scotland, national surveillance shows there are still 450-500 cases per quarter and this rate has been stable for 12-18 months. Therefore CDI reduction remains a priority.'

In the audit we record the type of antibiotic prophylaxis currently given in each unit (Fig. 17).

Fig. 17: Antibiotic prophylactic treatment



Forth Valley 'Other' antibiotic prophylactic treatment is Teicoplanin and Co-Amoxiclav

At other sites, many of the 'Other' types of antibiotic prophylaxis were given due to patient sensitivity to penicillin

Later in this report (see Outcomes section) we look at pre- and post-operative eGFR and any links to either ERAS principles or type of antibiotic prophylaxis in those with suspected acute renal injury.

Intra-operative phase

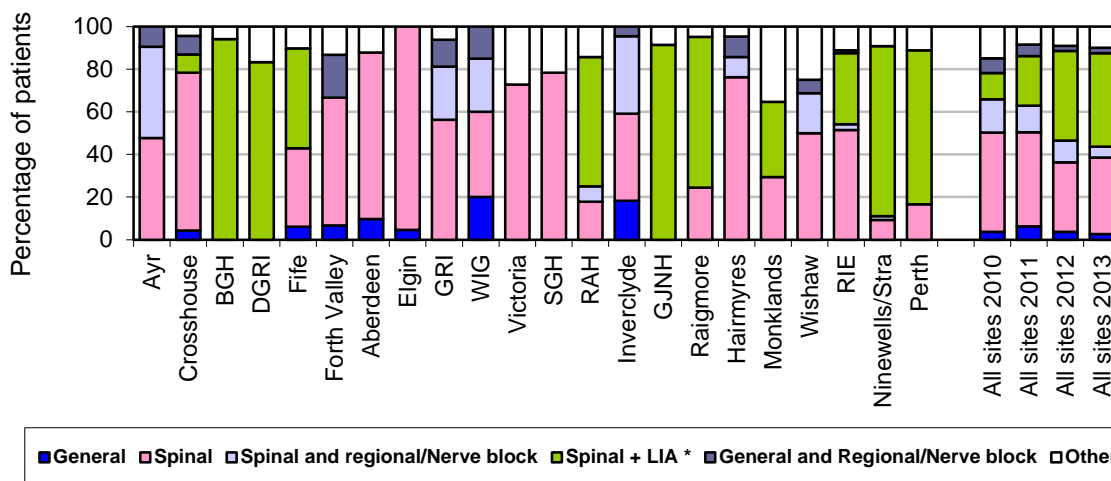
Anaesthesia

As per previous reports, the majority of patients in Scotland receive regional anaesthesia, predominantly spinal anaesthesia plus either local wound infiltration or peripheral nerve blockade. Over the four years of this audit there has been a significant shift away from regional nerve blocks to Local Infiltration Analgesia (LIA) for both hip and knee arthroplasty (53% of patients now receive LIA compared with 17% in 2010; Fig. 18).

Each unit will have its own preference for the method of anaesthesia, but whichever method is chosen, it should enable safe and early mobilisation of patients with an early return to normal function. What is encouraging to see is the intra-unit standardisation of anaesthesia over the past four years. Standardisation has two benefits. Firstly, it allows teams to measure the effects of their regimen on outcomes such as PONV and ease of early mobilisation. Local testing of certain elements can lead to a continual evolution of the pathway to make further improvements. Secondly, standardisation helps support a consistent approach in wards with the associated benefits of treating all patients the same and as part of an ERAS pathway.

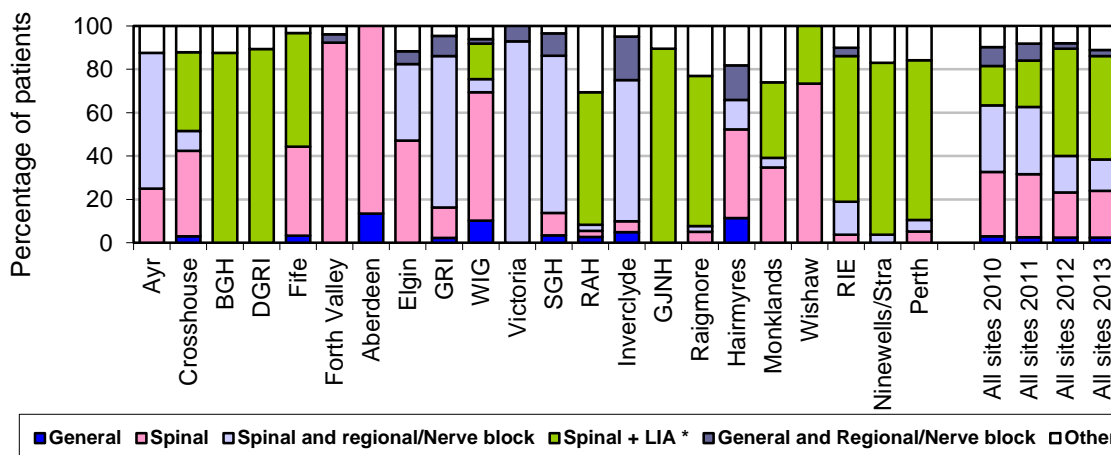
Fig. 18: Type of anaesthesia given

a) Hips



Some patients in the 'other' anaesthetic category received both general and spinal anaesthetic. Some of these were failed spinals that proceeded to GA.

b) Knees



* 7% of Spinal+LIA knee patients also received a Regional/Nerve Block.

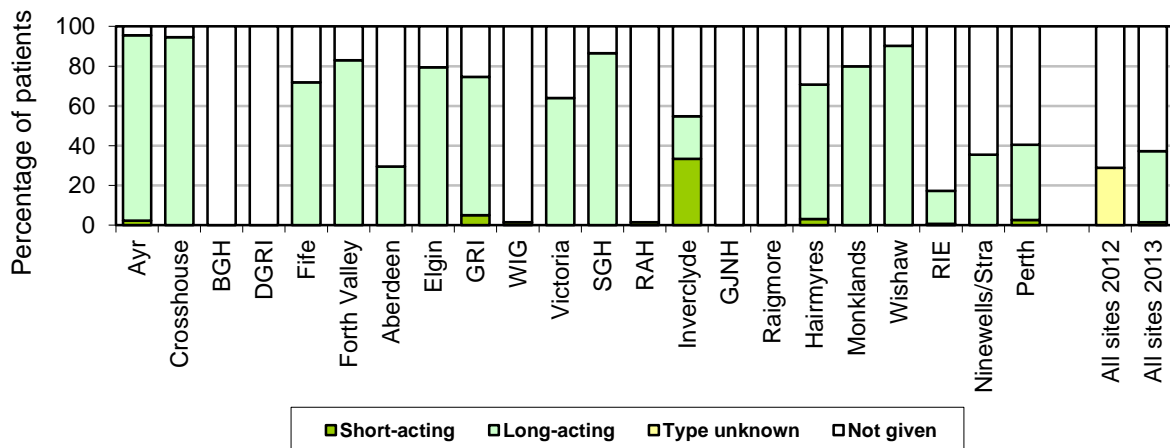
In 2013 'Other' anaesthetics were mainly failed spinals (40%) and GA+LIA (23%) with other combinations of epidurals, spinals, regional/nerve blocks, LIAs and GAs accounting for the remaining patients.

Intrathecal opioids are not included on this figure. These are plotted separately on Fig 19.

See Appendix B to read how one hospital introduced robust anaesthetic protocols to reduce variation in practice.

Intrathecal opiates have long been known to enhance pain relief, providing high quality analgesia for up to 24 hours after administration (Rathmell *et al.*, 2005). Units which favour their use feel that the quality of the analgesia they provide, combined with the absence of motor block and lower incidence of PONV compared to parenteral opiates, outweighs the known and previously described side effects of pruritis, delayed respiratory depression and increased urinary catheterisation rates. Units in which the incidence of urinary catheterisation and requirement for higher nursing to patient ratios are felt to be too high a price to pay for the analgesia provided, opt for other analgesic methods instead. Each clinical area has to decide on an appropriate outcome of this risk/benefit analysis independently.

Fig. 19: Intrathecal opioids administered



In this audit we record the use of intrathecal opioids given as part of any spinal anaesthetic and analysed its impact on post-operative outcomes with specific reference to post-operative urinary catheterisation. Of all patients who were given intrathecal opioids, 25% were also catheterised, compared to 11% of those who were not given intrathecal opioids. This difference may reflect the extent of ERAS and other practices across units rather than the use of intrathecal opioids *per se*, but does reflect the accepted evidence that intrathecal opiate is a cause of increased urinary catheterisation rates.

In 2013 we also collected data on dosage of intrathecal opioids for further analysis. Each site's own data is available on request.

IV Fluids

Goal Directed fluid Therapy (GDT) is a main-stay of ERAS programmes in other surgical specialities. However, in the awake patient any method of achieving this is difficult and is probably of less importance in arthroplasty surgery. The fluid debate continues and the question of type and volume of fluids to give has not yet been fully answered. It is clear that too little and too much fluid are both undesirable. In the case of arthroplasty surgery where blood and fluid loss is small and early oral fluid intake is possible, fluid regimens can afford to be more restrictive. Volumes of 0.5-1.5 litres are frequently cited in the literature.

It is therefore pleasing to see a significant increase in the number of patients having IV fluids stopped within 12 hours of surgery from 29% in 2011 to 52% in 2012 and 70% in 2013 (Fig. 21). In addition, 95% of patients had fluids down by the next day post-surgery. By removing the drip, patients are returned to normal oral intake of fluid earlier, encouraging independence.

See Appendix C to read one hospital's IV fluids protocol which has resulted in a low number of patients having IV fluids administered beyond the time they left the recovery room.

Fig. 20a: Type of IV Fluids - Intra-op

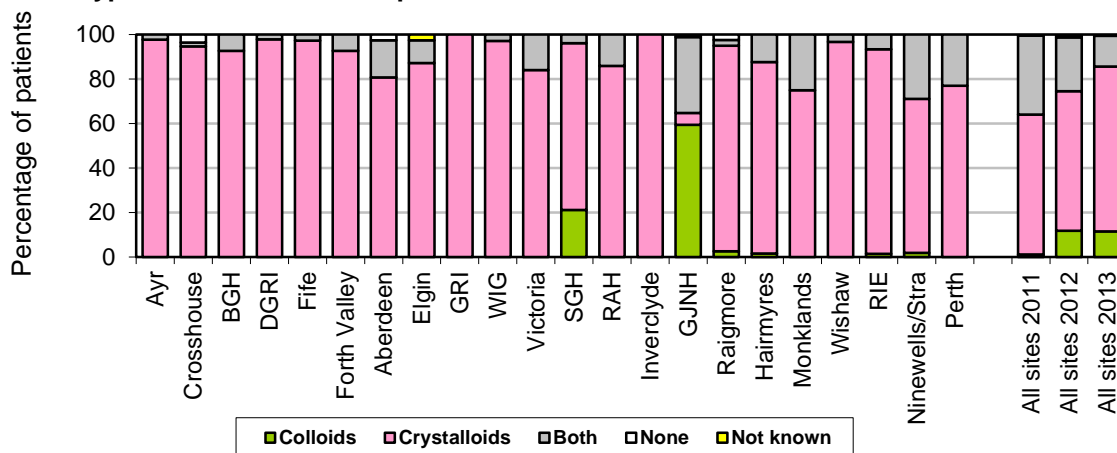
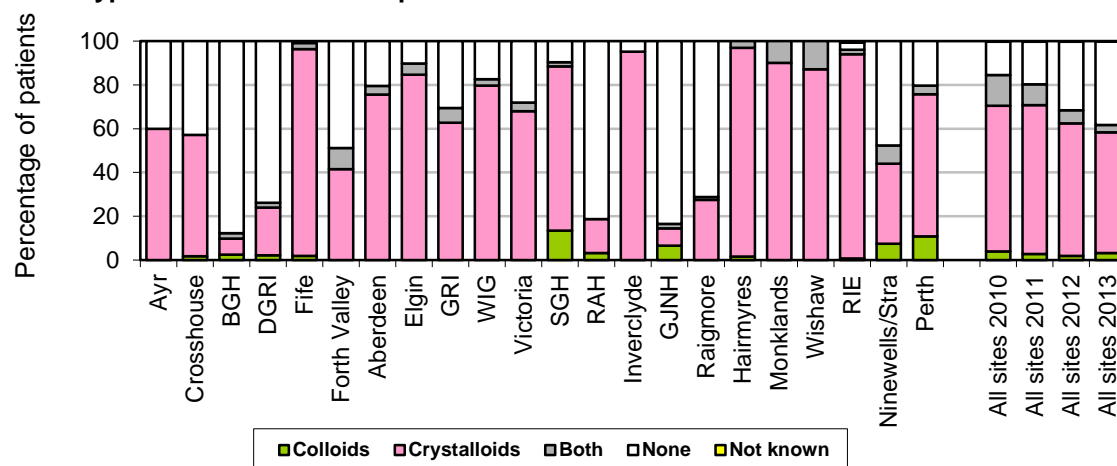


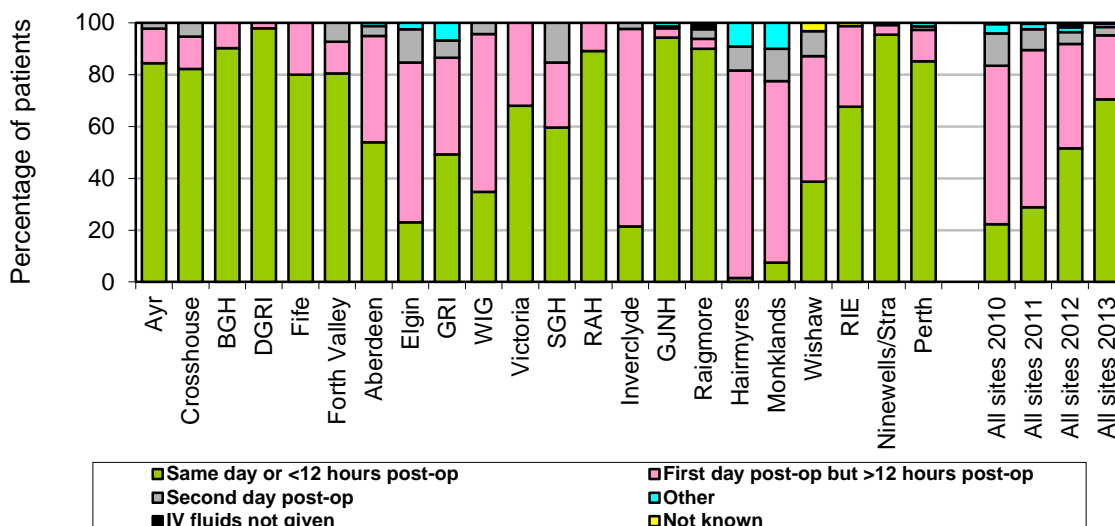
Fig. 20b: Type of IV Fluids - Post-op



In some units it appears that the patients are not given fluids in the post-operative period, but this may be due to poor documentation of the exact timings when IV fluids were administered. Therefore some patients may have had IV fluids commenced intra-operatively that would have continued into the post-operative stage.

In 2013 we also collected data on total volume of IV fluids given for further analysis. Each site's own data is available on request.

Fig. 21: IV Fluids discontinued

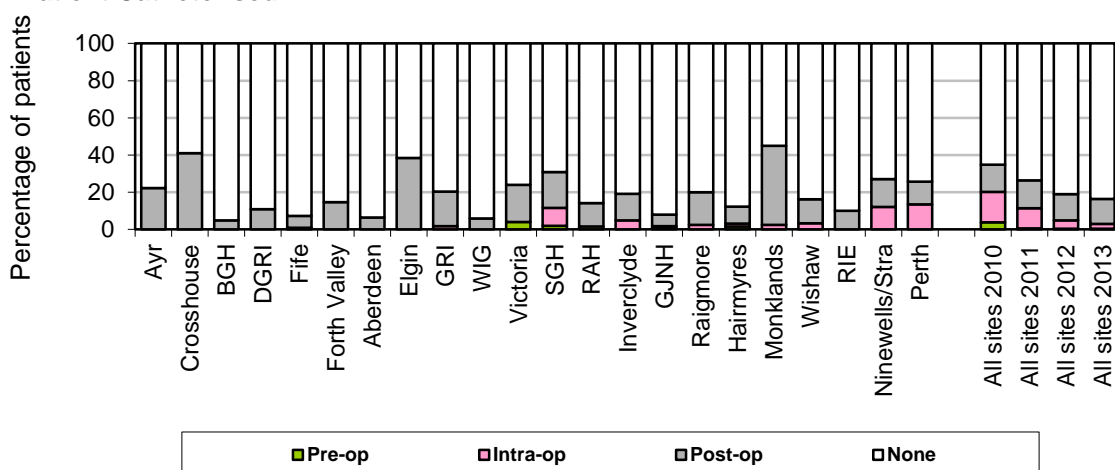


Some units have policies in place regarding discontinuation of IV fluids (providing this is clinically appropriate), e.g. some units stipulate that no patient should leave the Recovery Room to return to the ward with IV fluids in situ. For patients who are returned to the ward with IV fluids in situ, the production of local guidelines and staff education is important to ensure ERAS principles, clinical evidence and their benefits are understood by all staff working along the pathway.

Urinary Catheterisation

Over the four audits we have seen a major shift in practice in four units that routinely catheterised every patient and now only catheterise patients with a clinical need. There has therefore been a major national reduction in catheterisation rates from 35% catheterisation in 2010 to 16% in 2013 (Fig. 22).

Fig. 22: Patient Catheterised



There are local differences in criteria for post-operative urinary catheterisation. For example, Crosshouse routinely bladder scan patients every four hours if they have not yet passed urine, and catheterise if the residual volume is more than 500ml. In other units urinary catheterisation for post-operative retention is based on clinical assessment, and catheterisation is only performed if necessary. Early catheter removal is desirable.

Blood Transfusion

Since the first MSk audit in 2010 the blood transfusion rate has fallen from 19% to 10% following THR and from 9% to 4% for TKR (Fig. 23). Units are encouraged to ensure optimum pre-admission Hb levels to reduce the need for transfusions.

Fig. 23a: Patient Transfused – Hips

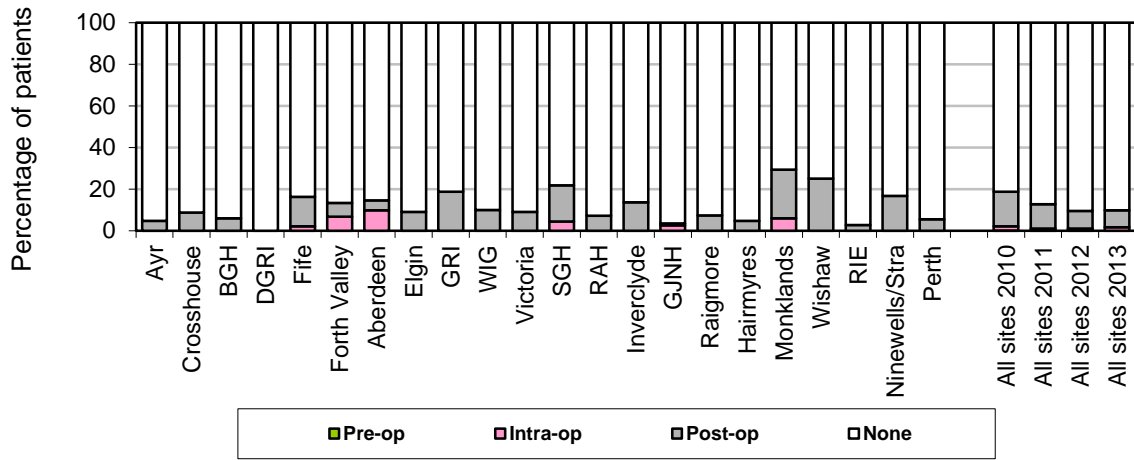
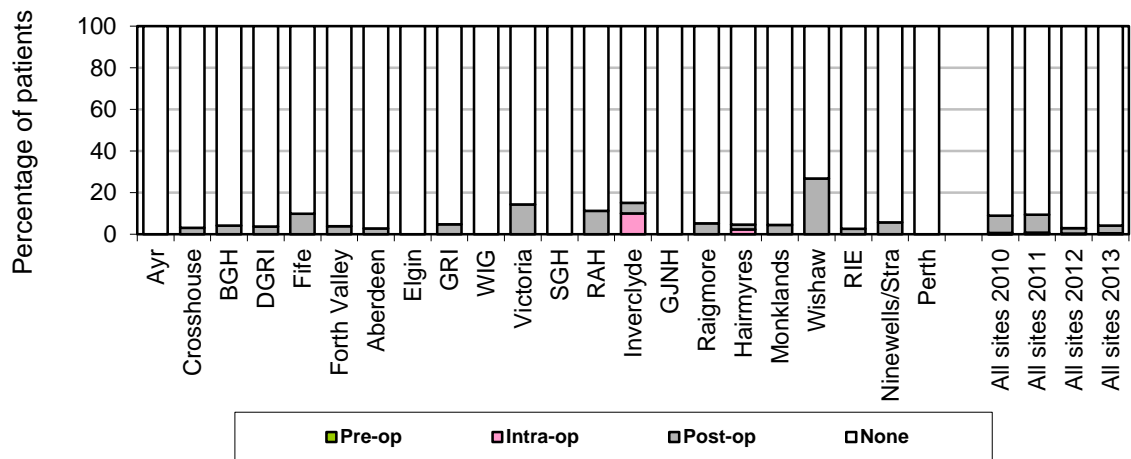


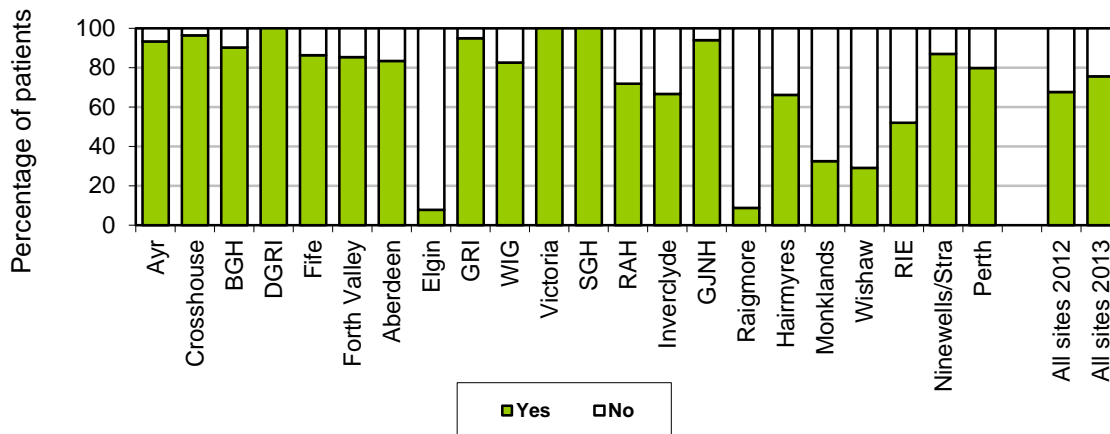
Fig 23b: Patients Transfused - Knees



The reduction in blood transfusion is probably due to the increased use of tranexamic acid and is a major achievement in a time when blood products are sparse throughout the NHS. In 2013, 76% of patients in Scotland received Tranexamic acid as part of their intra-operative management (Fig. 24).

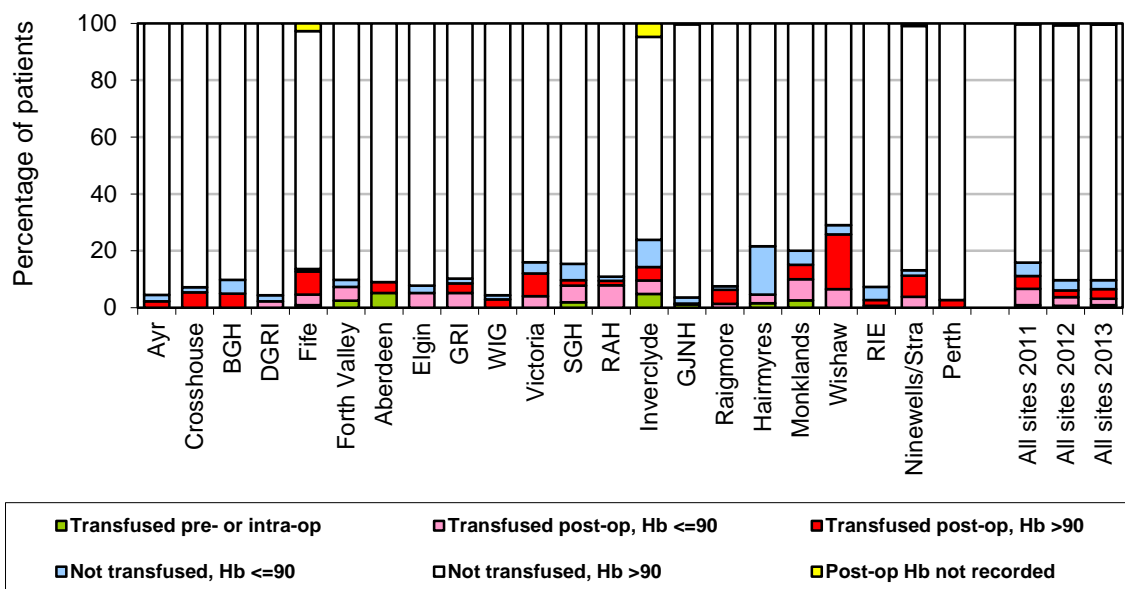
Five percent of patients who had been given tranexamic acid were given an intra- or post-op transfusion, compared to 11% of those who were not given tranexamic acid.

Fig. 24: Use of tranexamic acid



Since 2011 there has been a small reduction in the number of patients with post-op Hb > 90g/dl receiving a blood transfusion (Fig. 25), although there is still variation between units. Continued education of trainee medical staff and other staff groups is required to sustain this improvement. Scotland now has an overall transfusion rate of 7% for hip and knee arthroplasty.

Fig. 25: Transfusion regimens in relation to post-op haemoglobin levels – all patients



Post-operative phase

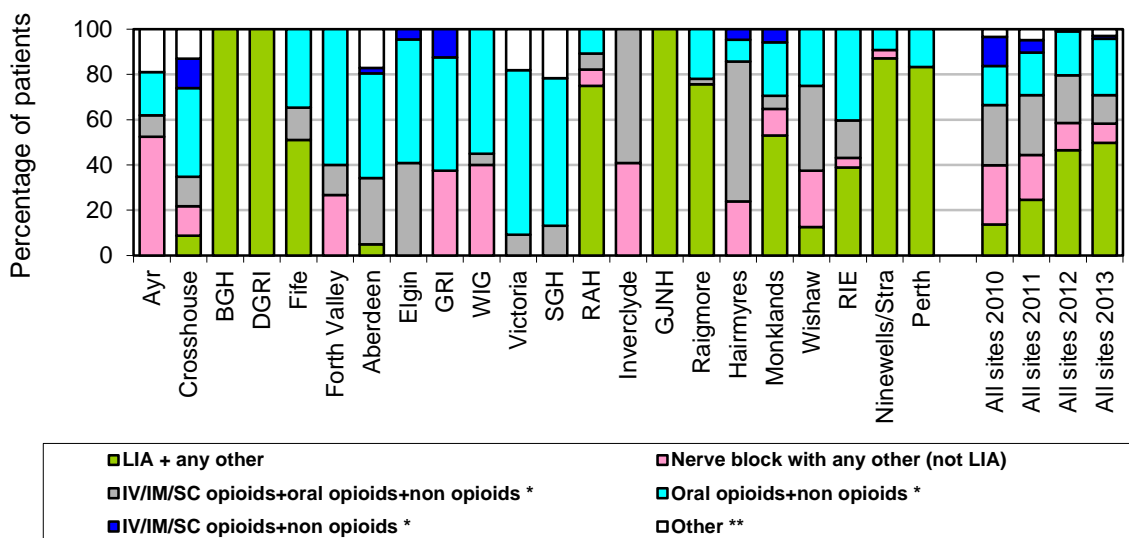
Analgesia

Within the past four years the majority of sites have moved towards standardising local post-operative analgesic regimens. This is very encouraging and makes the management of pain on the ward more straightforward and less dependent on anaesthetic or surgical staff preferences.

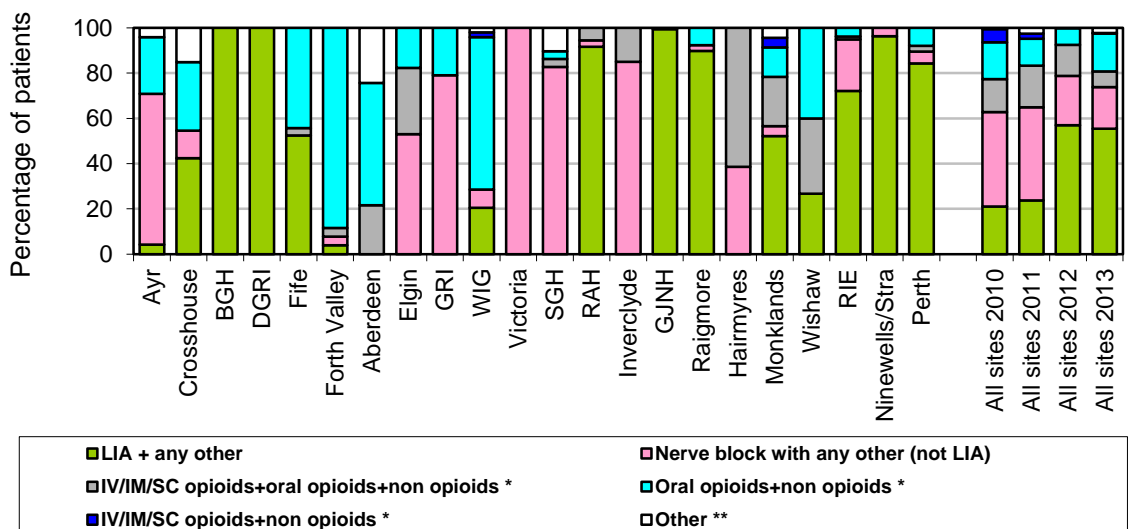
There has been a clear shift away from IV opioids for both hip and knee arthroplasty (Figs. 26 & 27). LIA has grown in popularity with 50% of hip patients and 55% of knee patients receiving it as the primary method of post-operative analgesia with a corresponding reduction in regional nerve blockades. Debate continues over the most effective post-operative analgesic regimen and with recent developments in distal nerve blockade and a myriad of different LIA cocktails described within the literature, maybe now is the time to look at multi-centre trials around Scotland to further improve pain management and return to normal function for patients.

Fig. 26: Post-operative analgesia prescribed

a) Hips



b) Knees



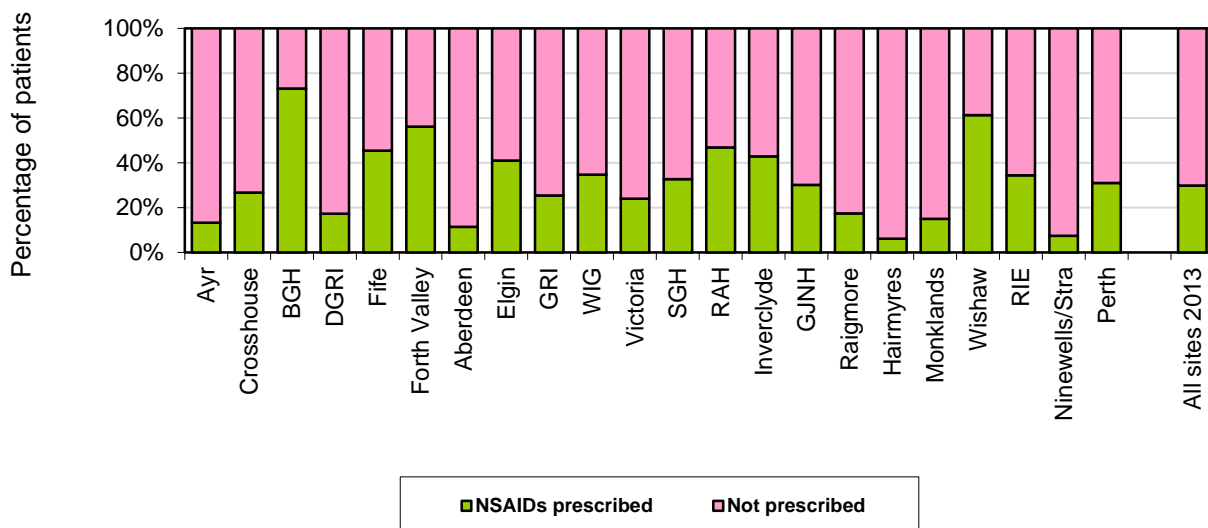
* Excludes patients who also had either LIA or nerve blocks

** Other = IV/IM/SC opioids, Oral opioids or Non-Oral opioids, or IV/IM/SC opioid with Oral Opioids

Some IV/IM/SC opioids may have been prescribed but not administered

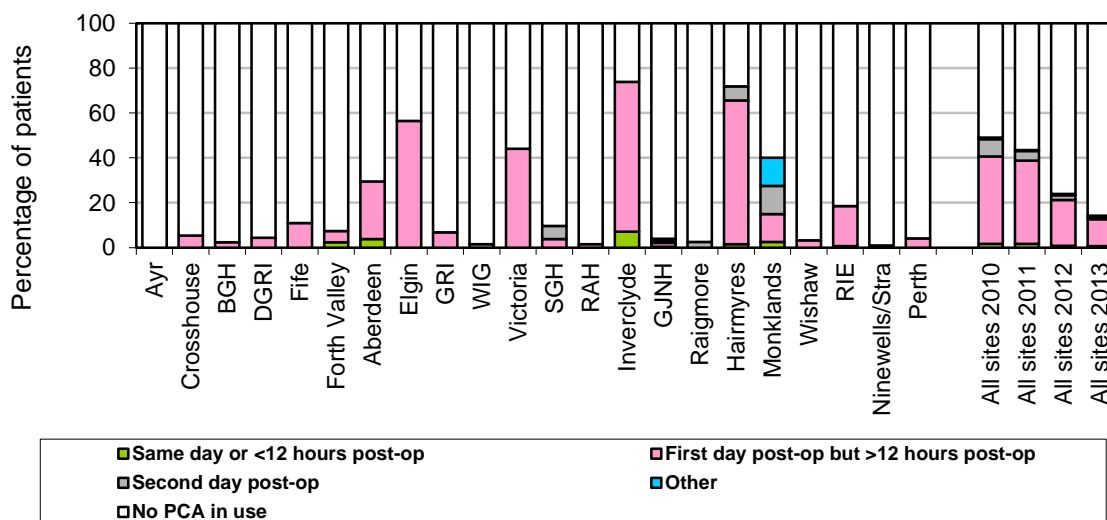
NSAIDs have been excluded from the above charts – see Fig. 26c below for NSAID use.

Fig 26c: Use of NSAIDs as additional post-op analgesia



There is little doubt that NSAIDs are an effective part of post-operative analgesic regimens. Concern has been expressed, however, over their contribution to acute kidney injury (AKI) particularly when used in association with aminoglycoside antimicrobial prophylaxis. Some hospitals stop all NSAIDs on admission to hospital whilst others prescribe oral or parenteral NSAIDs in the perioperative period and some believe that they get maximum benefit by combining parenteral preparations with their local anaesthetic (LIA) solutions. Anecdotal evidence suggests that the major **avoidable** contributory factor in the development of AKI is inadequate post-op hydration of the patient and, if this is prevented, NSAIDs are of little detriment. Further data are required, however, to confirm this.

Fig. 27: PCA discontinued



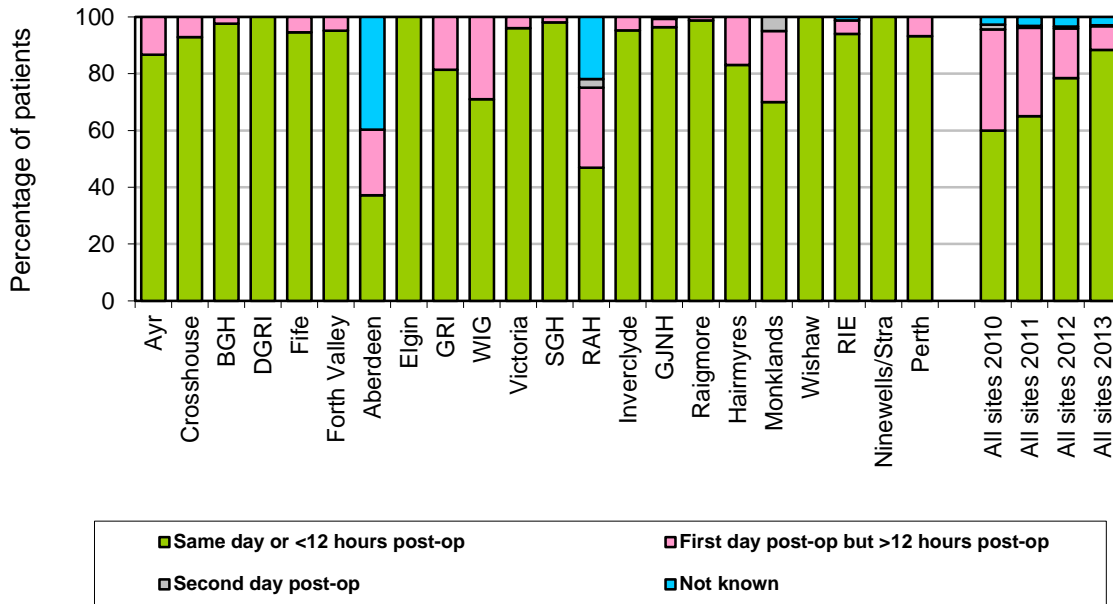
There has been a significant reduction in PCA use following arthroplasty surgery, from 49% of patients in 2010 receiving a PCA to 14% in 2013 (Fig. 27). As per previous reports, hospitals with lower usage of PCA morphine also tended to have higher same day mobilisation rates and lower post-op LOS. However, it is interesting to note that in hospitals that used PCAs in at least 20% of their patients, neither mobilisation was higher nor LOS shorter in the non-PCA group as compared to those given PCAs. This may indicate that it is the 'ethos' of ERAS within hospitals that matters rather than the effect of the individual components.

Diet

There has been a significant increase in the number of patients restarting diet on the same day as surgery from 60% in 2010 to 88% in 2013 (Fig. 28). Returning to normal diet as soon as possible further encourages the patient to feel like they are recovering quickly from the operation.

Overall, patients who had a general anaesthetic were less likely to recommence diet on the same day as their operation (84% versus 92%), and, as in 2012, this trend was also seen within hospitals, i.e. patients in a hospital who had a GA were less likely to recommence diet on the day of operation than the non-GA group.

Fig. 28: Diet recommenced



Note that Hairmyres and Monklands Enhanced Recovery programmes are relatively new. There is some evidence from the first cycle of the Rolling Audit for a week in January 2014 that patients are recommencing their normal diet sooner than they were since the data in this full audit was collected.

Post-operative nausea and vomiting and use of anti-emetics

Post-operative nausea and vomiting (PONV) is an unpleasant adverse event and a major cause of patient dissatisfaction whilst in hospital. With the exception of prolonged motor blockade, PONV is probably the main factor preventing early mobilisation. Efforts should be made to try and manage PONV pro-actively. The recorded incidence of PONV following joint arthroplasty ranges from 37 to 73% (Dorr *et al.*, 2008; Maheshwari *et al.*, 2006).

In this audit we recorded the highest nausea and vomiting scores over the first 48 post-operative hours. Some hospitals only record PONV when a PCA is in use (Fife, RIE) or for the first 12 hours post-op (Tayside), and others do not record PONV at all (DGRI, Wishaw and Monklands) (Fig. 29). After excluding these hospitals' data, and a further 1% of data from patients where full data for the first 48 hours was not available, 32% of patients had some nausea and vomiting during the first 48 hours after surgery (varying from 14-46% between units) (Fig. 30). Some of the extremes of this variation may be due to small sample sizes or differences in the method of documentation rather than genuine differences in PONV between units. We may be underestimating the true extent of the problem due to the difficulties inherent in the data capture processes. Units are encouraged to review their rates and documentation protocol further.

Fig. 29: PONV recording during the first 48 post-op hours

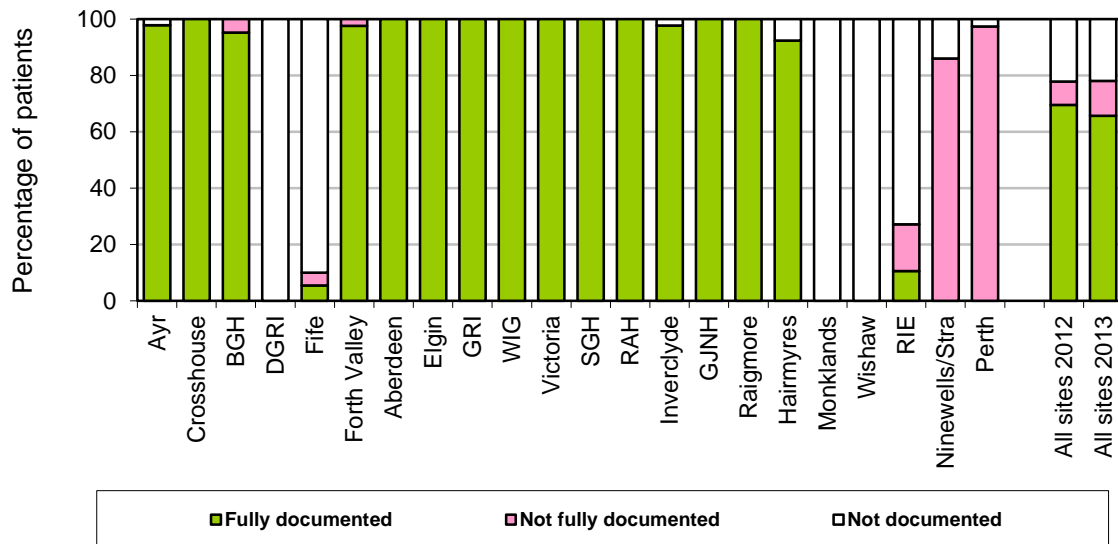


Fig. 30: Maximum PONV score recorded during the first 48 post-op hours

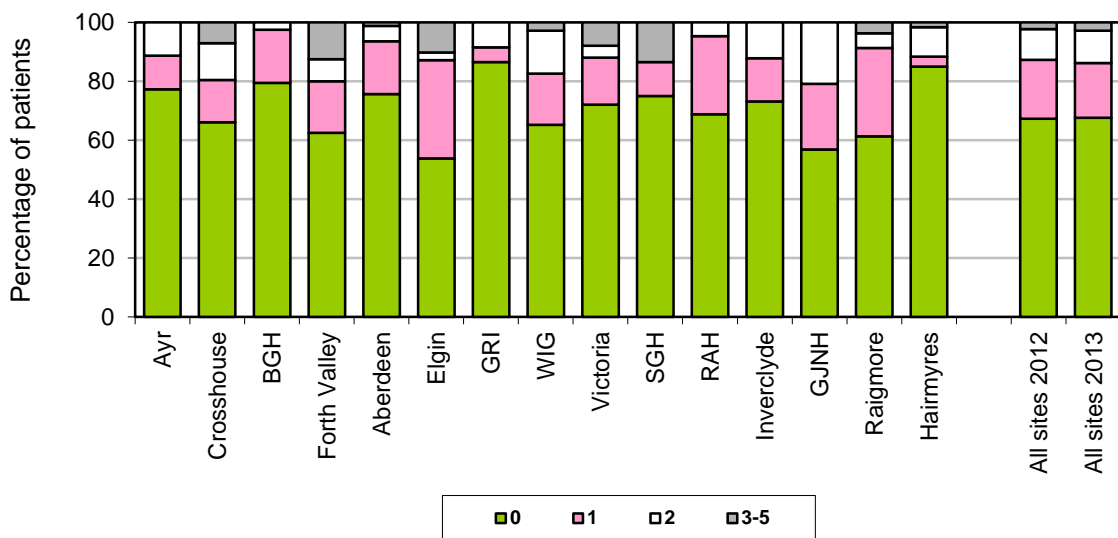
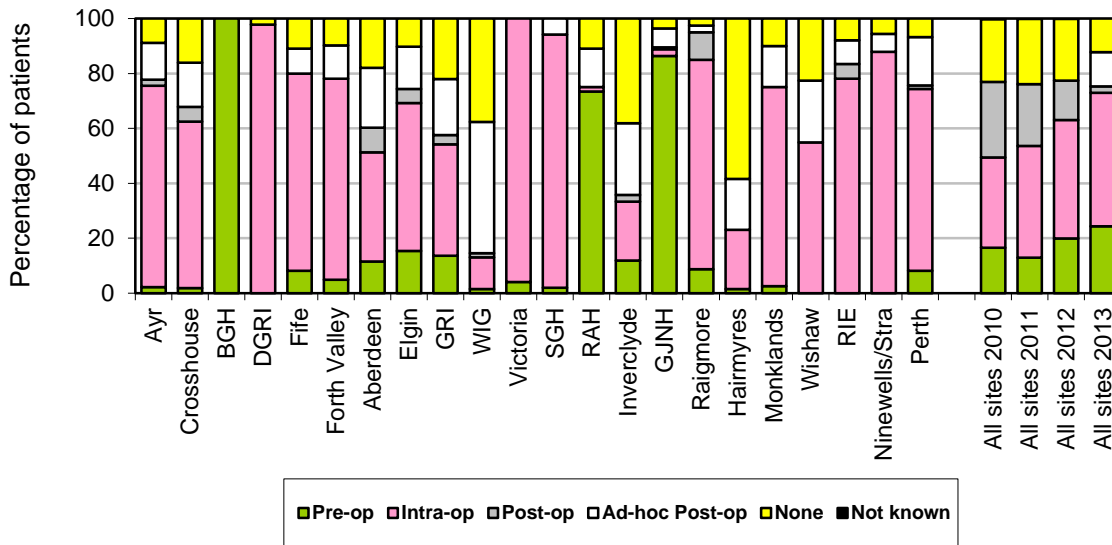


Fig. 30 only includes data from patients with full documentation during the first 48 post-operative hours.

Fig. 31: Time first anti-emetics administered



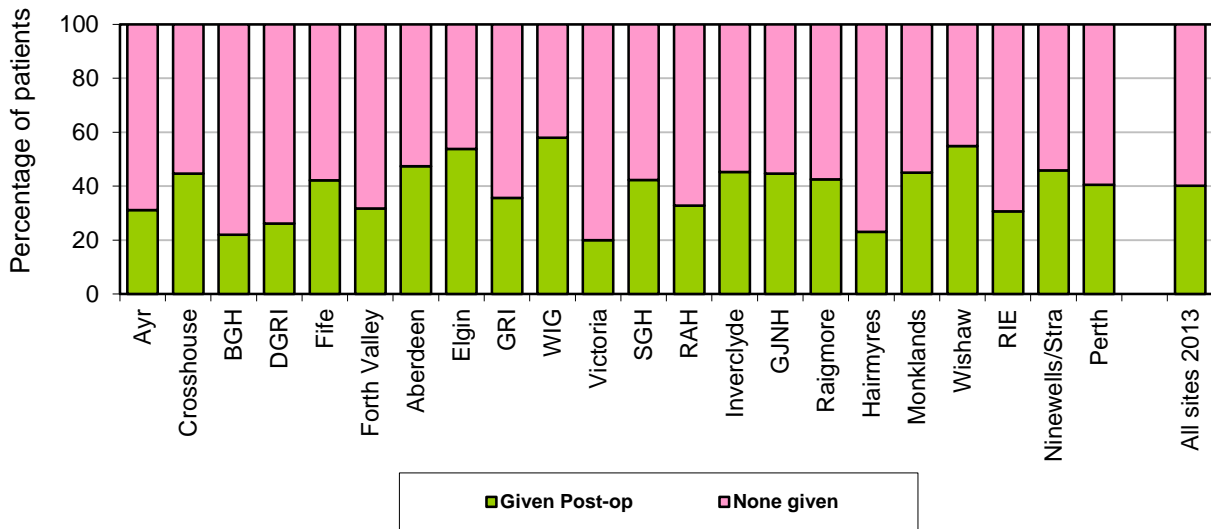
Note that this measure has changed over time: no distinction between prophylactic and adhoc anti-emetics was made in 2010 or 2011, whilst only prophylactic anti-emetics were recorded in 2012. In 2013, both prophylactic and adhoc anti-emetics were recorded separately. The increase in earlier prophylactic administration over time does, however, appear to be genuine. As a result of staff shortages, we were unable to confirm the higher than average ad hoc administration rate of anti-emetics for GRI and WIG, so please treat this result with caution.

See Appendix D to read how one hospital introduced an anaesthetic department protocol for the prescribing of anti-emetics.

Full analysis of the PONV data is difficult due to the nature of the quantitative versus qualitative scoring of both nausea and vomiting and the timing of administration of anti-emetics. However, in 2012 we showed that units that included more of their patients in an ERAS programme had a lower incidence of PONV over the first 12 hours and over the first 48-hour period. Results were similar in 2013 (17% PONV for all ERAS patients vs. 23% non ERAS in first 12 hours, 31% vs. 39% in first 48 hours). The difference in PONV rates could be due to such factors as use of multimodal analgesia and prophylactic anti-emetic prescribing.

Prophylactic administration of anti-emetics (either intra-operatively or early and regular post-operatively) is likely to be more effective than early therapeutic administration. On average 40% of patients were also given ad-hoc anti-emetics (Fig. 31b). This was less frequent in patients given prophylactic anti-emetics pre- or intra-op (37%) compared to those not given anti-emetics prophylactically (51%).

Fig 31b: Use of ad-hoc anti-emetics

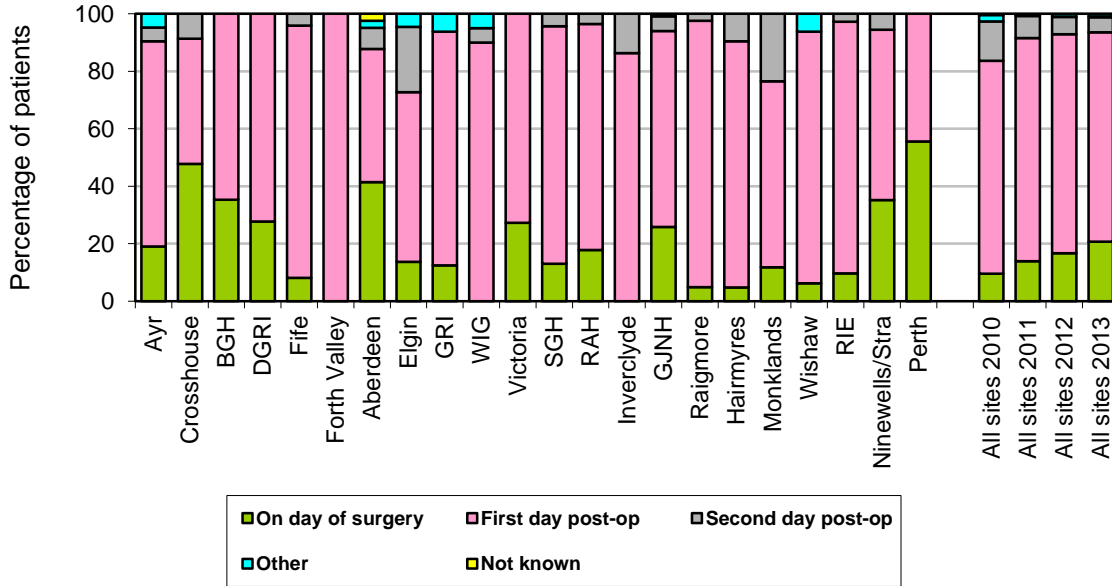


Mobilisation (up to stand/sit)

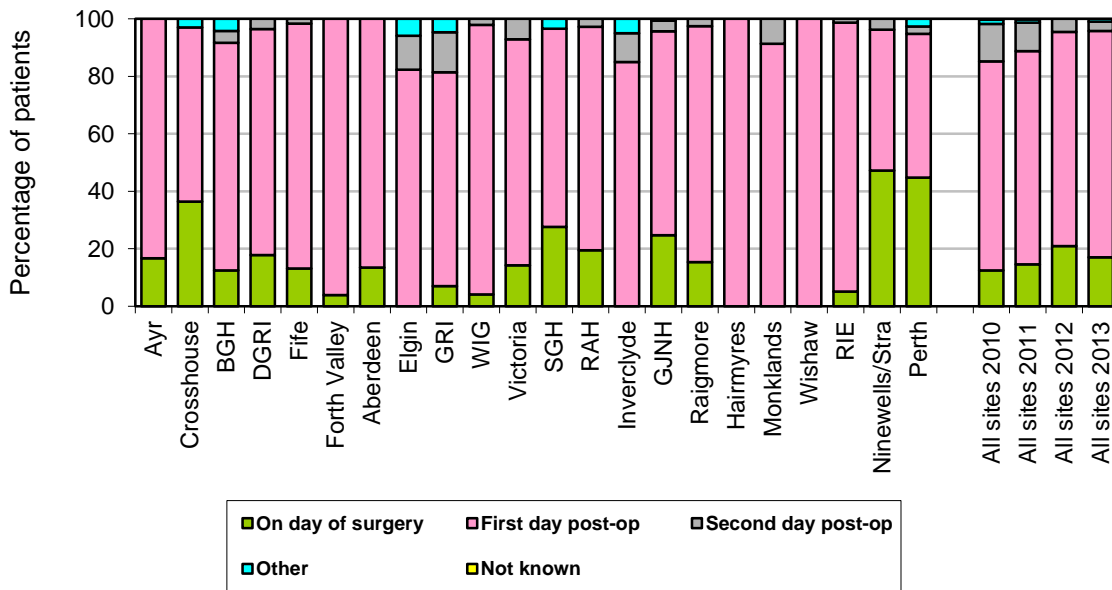
Hospitals should be encouraged to aim to mobilise all patients, with a few exceptions for medical reasons, within 24 hours of surgery. Nationally, the proportion of patients mobilised on the same day as surgery, or by the next day, has increased from 84% in 2010 to 95% in 2013 (Fig. 32).

Fig. 32: Post-op mobilisation (up to stand/sit)

a) Hips



b) Knees



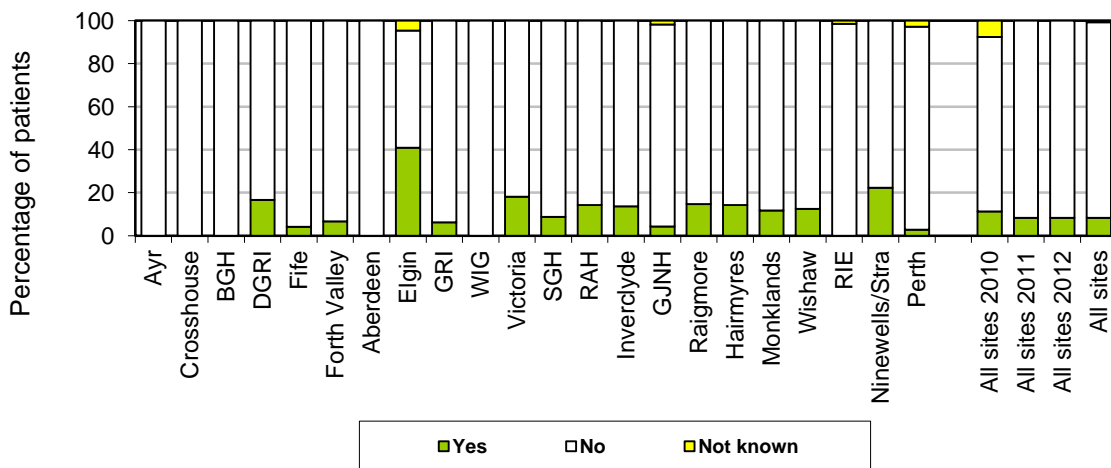
Post-Discharge Physio

There has been very little change over the three years in the rates of patients being referred for outpatient physiotherapy on discharge (Fig. 33).

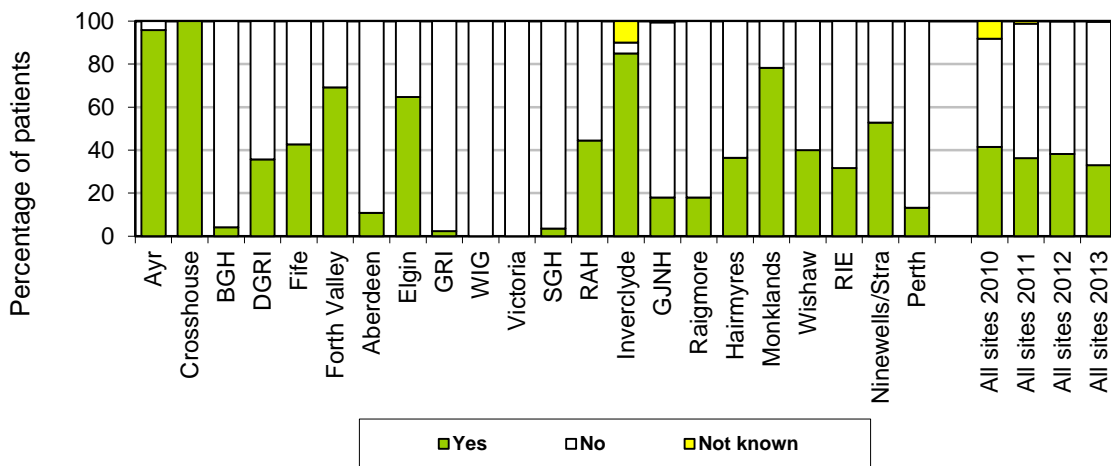
With the continual demand on MSK services, and the new target of only 4 weeks wait for outpatient therapy by 2016, it is imperative that the need for outpatient therapy is reviewed and consideration given to how we best use a finite resource. Interestingly a number of internet-based rehabilitation programmes, with patients encouraged to follow exercise programmes, have been shown to be as effective as outpatient therapy (Russell *et al.*, 2011).

Fig. 33: Post-discharge Physio planned?

a) Hips



b) Knees

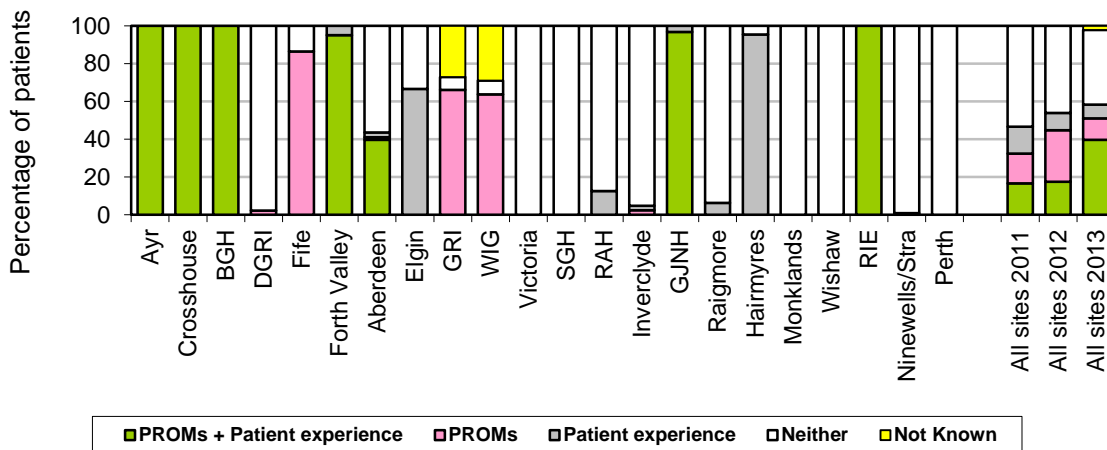


Patient experience and PROMS

Although several sites are routinely collecting Patient Reported Outcome Measures (PROMS) and patient satisfaction information, it is disappointing to see that many sites are not collecting anything at all for most patients (Fig. 34). Use of PROMS and patient experience information is an extremely important element of continuous improvement.

See Appendix E to read how one hospital collects and uses patient experience data to focus on improvements.

Fig. 34: Patient experience and PROMS



RAH data could not be collected on an individual patient basis, but entry above based on local estimate that approximately 12% of patients get patient experience questionnaires.

The yellow bar for GRI and WIG refers to hip arthroplasty patients. The Local Audit Co-ordinator in these hospitals was only available for a short period and did not collect this information at the time.

Outcomes

Length of Stay

The MSK and Orthopaedic Quality Drive aims are:

- for arthroplasty patients across Scotland to have the best practice interventions along their care pathway that enhance their experience and optimise their recovery so that they reach their discharge criteria as soon as possible.
- for five days or less to be the norm for post-operative length of stay for at least 85% of patients (already achieved by the top quartile of hospitals in this audit).

Nationally, length of stay continues to fall (Figs. 35 & 36). The median length of stay in 2013 including any pre-operative stay was five days for knees and four for hips compared to six days for both in 2010.

Mean post-op length of stay also continued to fall, from 5.58 days in 2010 to 4.76 days in 2013. The median post-operative length of stay is now 4 days for both hips and knees. 36% of patients are discharged within three days of surgery, 75% of patients within 5 days.

See Appendix F to read how one hospital has reduced their average length of stay considerably.

Fig. 35: Length of stay (date of admission to date of discharge)

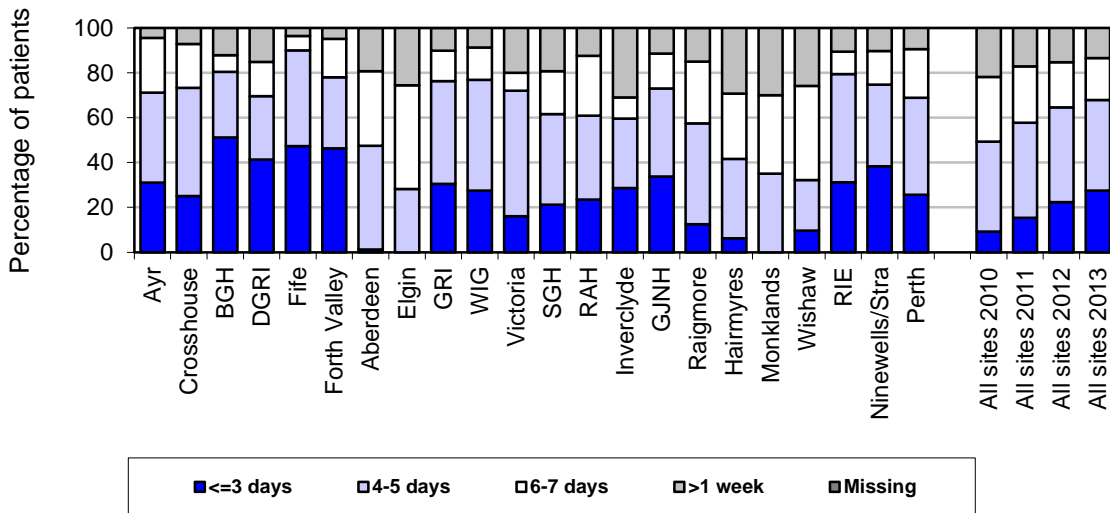
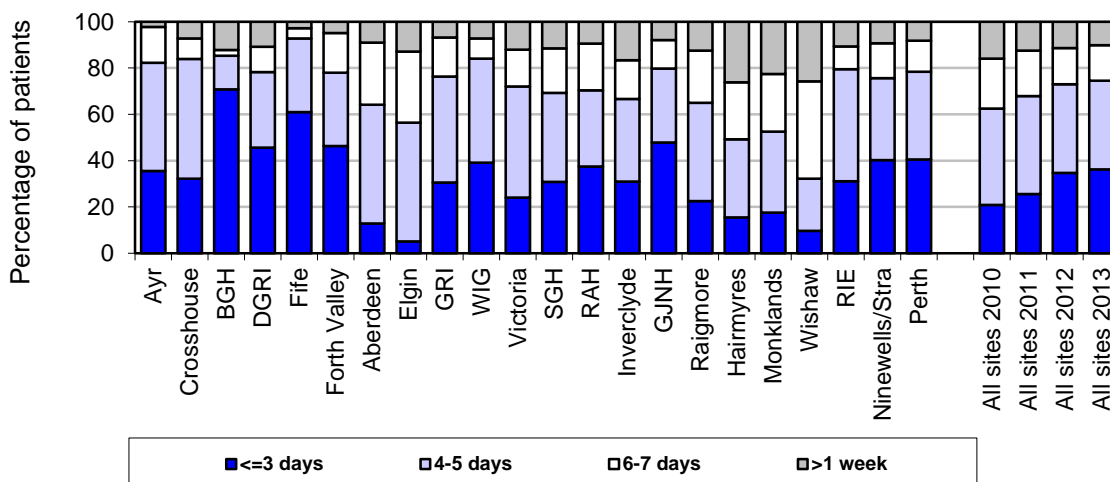


Fig. 36: Length of post-operative stay (date of operation to date of discharge)

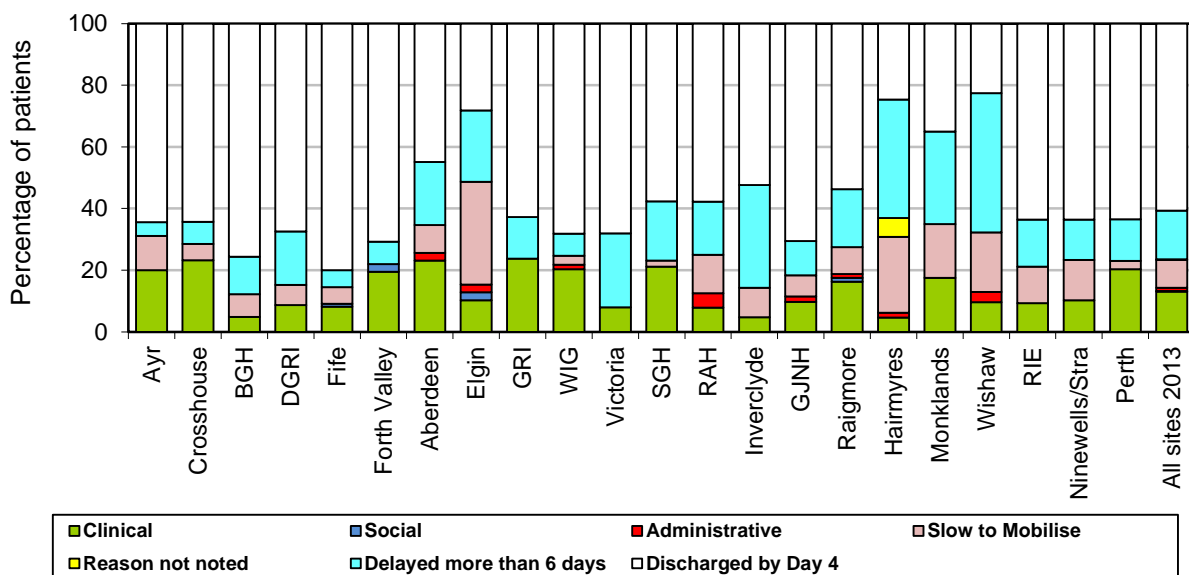


Note that Hairmyres, Monklands and Wishaw Enhanced Recovery programmes are relatively new. There is some evidence from the first cycle of the Rolling Audit for a week in January 2014 that Post-Operative Length of Stay has been reduced at Hairmyres since the data in this full audit was collected.

In this 2013 audit, for those patients still in hospital on Day 5 to Day 7 post-op, we recorded reasons why they had not been discharged. This differed from a more arbitrary definition of delay to discharge in previous audits, and included an additional category of 'Slow to mobilise'.

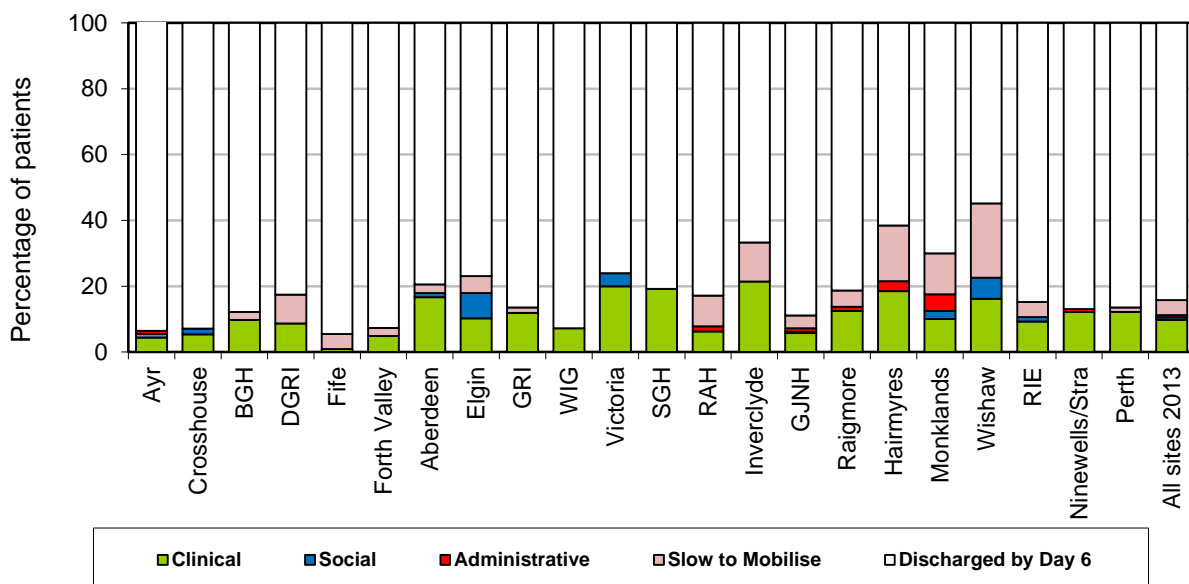
Overall 61% of patients had been discharged by post-operative Day 4, 84% by post-operative Day 6. Fig. 37a shows reasons why patients were discharged on either Day 5 or Day 6. Although 13% of patients discharged on Day 5 or Day 6 were not discharged earlier for clinical reasons, a further 9% were not discharged because they were simply slow to mobilise, and this problem varied between units. Many of the same units had similarly higher 'slow to mobilise' rates as reasons why patients were discharged after Day 6 (Fig. 37b).

Fig. 37a: Reason for delay to discharge if discharged on Day 5 or Day 6



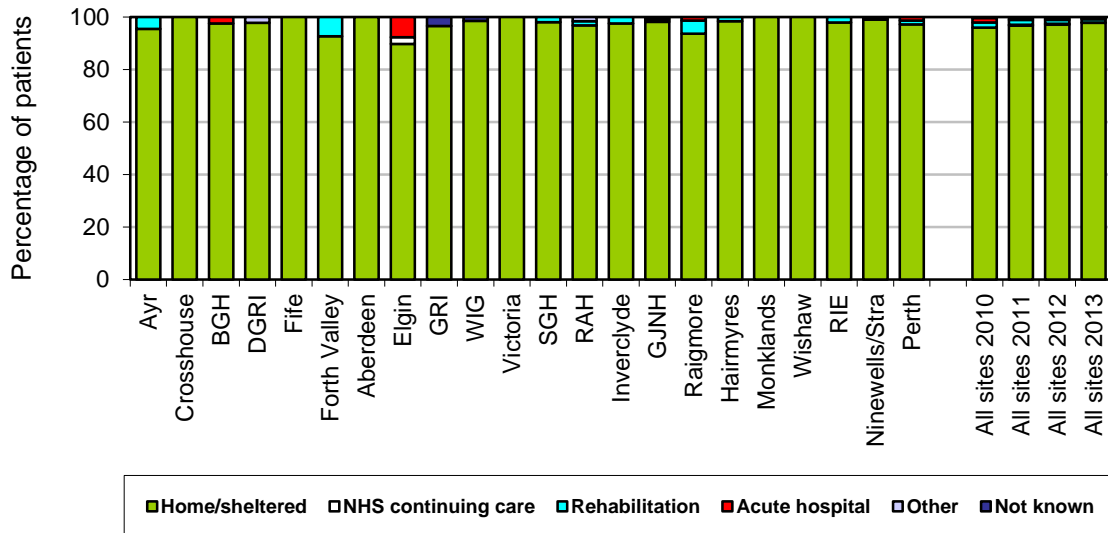
Note that the area in bright turquoise-blue on Fig. 37a represent patients discharged more than 6 days post-op, and is simply the same area for all bars on Fig.37b.

Fig. 37b: Additional reasons for delay if discharged after Day 6



It is reassuring to see that administrative reasons (e.g. delay in social services provision of requirements) does not feature particularly frequently.

Fig. 38: Discharge destination



Due to the large geographical area covered by NHS Highland, some patients were discharged from the main provider unit to a hospital closer to home to continue to convalesce/receive rehab. The date of discharge relates to the date the patient was discharged from the main care provider unit at Raigmore.

Renal function

A common area of concern regarding the use of ERAS has been post-operative renal function. We therefore looked at the pre-and post-operative eGFR of all patients to investigate the incidence of post-operative renal impairment (Figs. 39 & 40) and try to identify possible causes.

Of those who had normal eGFR (> 60) pre-op, 11% became abnormal (<=60) post-op. This percentage increased with age, ASA and number of co-morbidities, and also varied between hospitals (Fig. 40). Further preliminary analysis of the 2013 data suggests that methods of anaesthesia, premeds, DVT prophylaxis or antibiotic prophylaxis may also be associated with the risk of renal complications, but this awaits further analysis and advice.

Fig. 39: Pre-operative eGFR

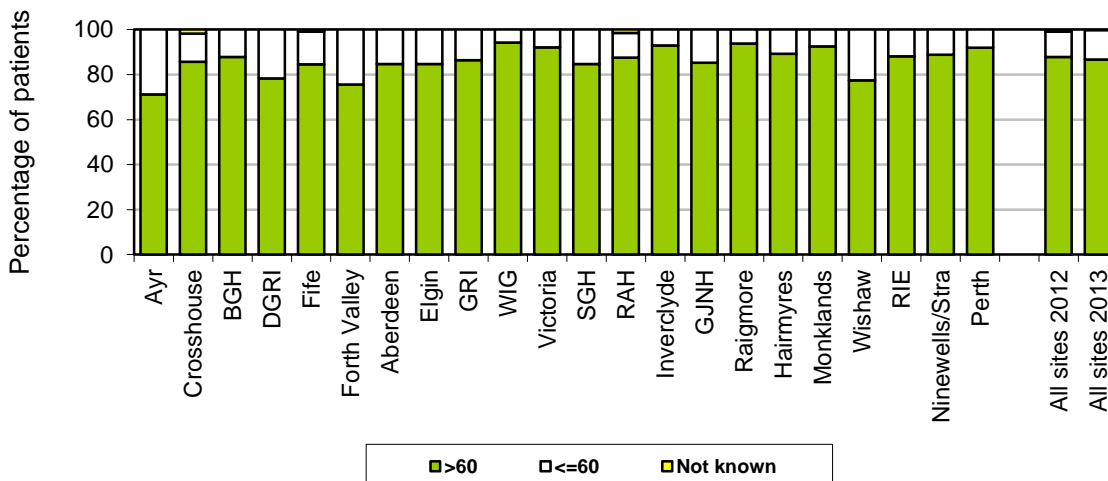
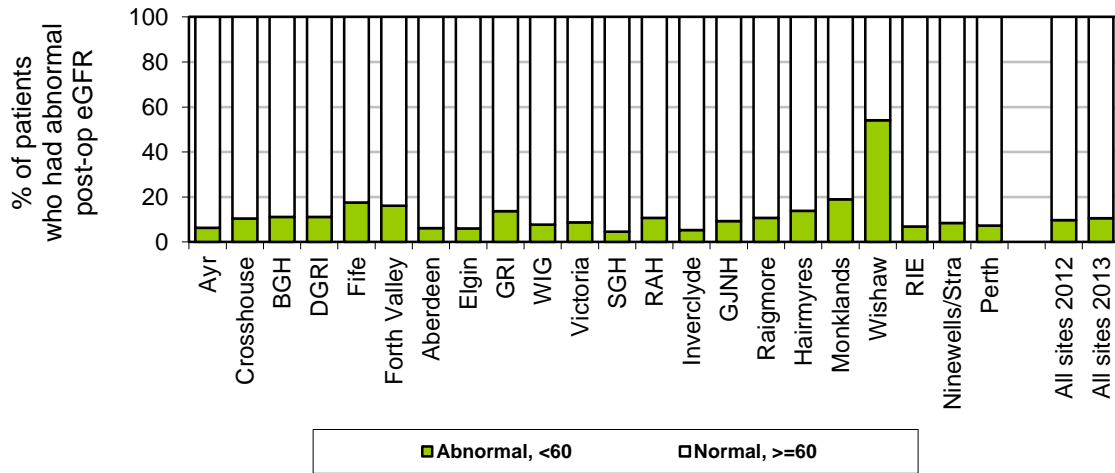


Fig. 40: Percentage of patients with normal pre-operative eGFR (>60) who had abnormal eGFR (<=60) post-operatively

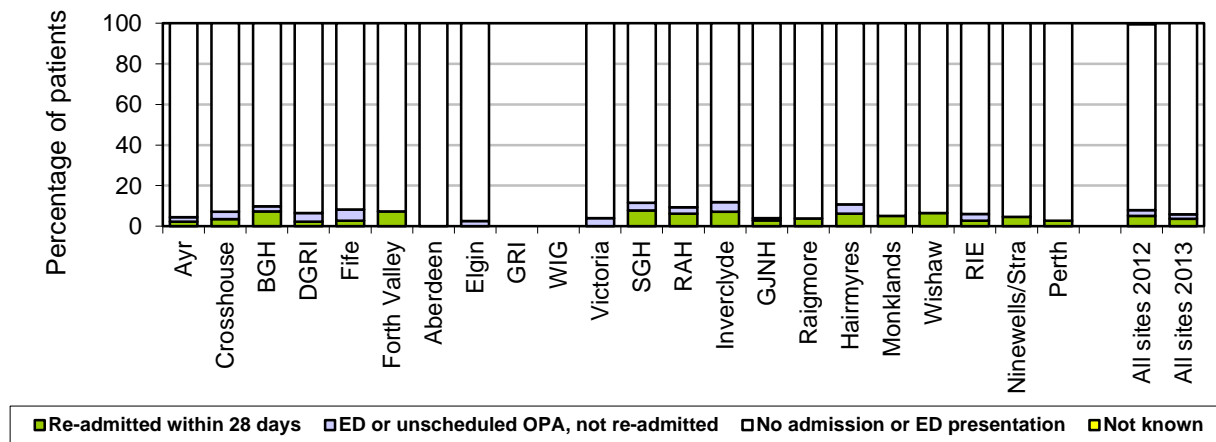


Since this data was collected, Wishaw have changed their protocol regarding the administration of Flucloxacillin and Gentamicin.

Re-admissions within 28 days

We reviewed readmission data for all patients included in the audit. It is encouraging to see a low rate of readmission across the majority of sites.

Fig. 41: Re-admission within 28 days of operation



Data for GRI and WIG unavailable.

Importantly for the on-going support of ERAS pathways by patients and all NHS staff, there was no statistically significant relationship between units' re-admission rates and the percentage of patients that they managed as ERAS patients, or the units' mean post-operative length of stay.

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Appendix A:

Fasting and Fluids - Borders General Hospital

At the Borders General Hospital fasting times for solids and liquids are minimised. All patients are instructed to have a snack before bed time on the day before the operation. Afternoon patients are usually instructed to have an early light breakfast, such as dry toast with black tea or coffee, before 6am on the day of surgery. Additionally, all patients are prescribed a drink of water on their kardex to be given 2 hours before their anticipated operative time.

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Tayside

Tayside send letters to patients that detail their expected slot on the theatre schedule. On the basis of the theatre slot the letters provide advice regarding what to eat and drink until when.

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Appendix B

Anaesthetic Protocols – Dumfries and Galloway Royal Infirmary

We have had universal uptake of the ERAS protocol in DGRI with almost all patients following the protocol. The few exceptions have been patient refusal for regional anaesthesia or contraindication for such. Key to this uptake was the enthusiasm of both theatre teams and ward teams to take the new protocol on board.

The Joint School has prepared patients for the surgery. The orthopaedic surgical team has universally accepted the protocol as have the anaesthetic department. The ward staff have contributed to this by ensuring administration of premedication on time and following post op analgesic regimes.

Our protocol has evolved and we are still in the process of achieving the best possible regime.

We did a trial with slow release Morphine (MST) in place of Oxycontin but nausea and vomiting rates went up during this period so we reverted back to Oxycontin.

When we initially started, our post op analgesic regimen involved use of intra-articular catheter and local anaesthetic delivery through a pump. Due to problems related to catheter blockage, displacement and pump failures this was substituted with a Local Infiltration Analgesia at time of surgery.

The intra-operative phase in our ERAS Programme consists of spinal anaesthesia with Local Infiltration Analgesia (LIA) for both hip and knee arthroplasties.

Since September 2013 we added Ketorolac, Adrenaline and Morphine in to the LIA mixture, as post op pain was a significant problem post knee arthroplasty. This was leading to impairment of post op mobilisation and subsequent discharge. (Since post operative pain was not found to be a significant problem for hip arthroplasty the protocol was not changed for this.)

An audit of the change in the knee arthroplasty protocol is being conducted at present but early data show improvement in pain scores during the first 18-24 hours but not significant benefit thereafter.

We are in the process of reviewing the postoperative ward analgesic regime to address this problem.

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Appendix C

Peri-operative Fluid Regimens in ERAS patients - Highland

Goal directed fluid therapy is a mainstay of ERAS programmes in many surgical specialties. Although the question of the ideal volume and type of fluid required in arthroplasty surgery has yet to be answered it is clear that too little and too much fluid are both undesirable. Excessive peri-operative fluid leads to tissue oedema and a number of post-operative complications such as poor wound healing, compromised respiratory function and a dilution of haemoglobin and clotting factors which may promote bleeding. Continuing intravenous fluids and the subsequent increase in volume of urine production increases the likelihood of catheterisation and together delay mobilisation of the patients. Inadequate peri-operative fluid administration, however, may lead to hypotension, dizziness, vasovagal attacks and occasionally acute renal failure and inadequate tissue perfusion and should be avoided.

Blood and fluid losses are normally low in arthroplasty surgery and fluid regimens can afford to be more restrictive particularly when regional anaesthesia has been used and patients can resume their oral intake as soon as possible. Typical intravenous infusions vary between 1.0-1.5 litres (hip replacements generally requiring a greater volume than knees) but the majority of patients should not require IV fluid therapy post operatively and the drip should be taken down before leaving the Recovery Suite unless instructed otherwise by the anaesthetist. In most cases patients will feel thirsty if under-filled and, if allowed, will be able to regulate their fluid balance themselves so should be encouraged to drink clear fluids (or tea/coffee if available) in the Recovery Room. On return to the ward a jug of water should be placed by the patient's bed. Occasionally the fluids administered in theatre will be inadequate resulting in patient hypotension and a possible reduction in tissue perfusion so a rescue pathway must be available. The first step of this pathway should be a continuation of oral fluids e.g. 2 glasses (300mls.) water followed by a rechecking of blood pressure in 30 minutes. If this proves to be inadequate then a bolus of intravenous fluids e.g. 500 mls crystalloid should be administered. The anaesthetist should be informed of persisting unresponsive hypotension.

Fluid Administration

1. Arthroplasty patients rarely require large volumes of I.V. fluids (e.g. 1.0 – 1.5 litres)
2. Patients should be encouraged to drink as soon as possible e.g. clear fluids, tea/coffee in Recovery
3. I.V. drips should be discontinued before leaving Recovery Room
4. Patients should be encouraged to eat and drink on return to ward
5. A **Rescue Pathway** should be in place for the occasional patient who exhibits persistent post-operative hypotension. This may comprise boluses of oral fluids (e.g. 2 glasses of water) and, if insufficient, followed by a bolus of intravenous fluid.

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Appendix D

Antiemetic use – Ayr Hospital

Our hospital has a relatively unified approach to anaesthesia for hip and knee arthroplasty. As a department, we have found it comparatively easy to disseminate guidelines and exchange ideas as we are a small group of anaesthetists.

There is a written Enhanced Recovery Guideline for Hip and Knee arthroplasty advising on the administration of antiemetics which includes dexamethasone 8mg (either as an oral premed or more often given intravenously in theatre). Dexamethasone was chosen both for antiemetic and analgesic effects at this dose. Postoperative prescribing for analgesia and symptom control is generated electronically with a prescription 'bundle'. This helps with consistency in prescribing and administration postoperative medications. This includes regular and breakthrough analgesia, and antiemetics including prophylactic prochlorperazine 3mg (buccal) for 2 days postoperatively to minimise symptoms. This was instituted after routine postoperative follow-up highlighted PONV was problematic on occasions, which was not often predictable. The buccal route was chosen for ease of administration from a nursing perspective and patient acceptance. On occasions patients have declined prophylactic antiemetics, and later suffered symptoms. We are encouraging nursing staff to educate patients on the importance of prophylactic medication, thus improving compliance.

We have ongoing review of our postoperative patients and have adjusted our guideline as a result of this.

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Appendix E

Using outcomes in practice – Royal Infirmary of Edinburgh

14 years ago we began to gather data on all the patients undergoing arthroplasty for two reasons.

1) academically gathering the data provided a basis for future publications (so we required formal ethics approval)

2) there were a number of surgeons performing arthroplasty and we wished to change some of the ways they worked and disprove some strongly held beliefs e.g. patients like to stay in hospital and do better as a result. We began with simple general health measures, specific joint scores and simple questions about what was good and bad about their care. All the patients signed the sheet as formal consent to analyse and retain the data.

Embedding the collection into the process of care was difficult but once there gathering the data was 'easy'. Analysis is by mechanical/ computer reading with overall human check. For a short while we stopped data gathering, this was a mistake, restart was extremely difficult, keep gathering data - the system has value.

We post out questionnaires at 6 months to maintain contact with the patient and again at 1 year. Latterly these have gathered the generic data and we have used them to look not just at PROMs but at PREMs, the **experience** of health care delivery.

Yearly reports are produced for the individual surgeons and the department. This is always an eagerly anticipated event with the results shared and the topic for coffee discussion all month! Peer pressure evokes change.

We recently reviewed the factors associated with satisfaction following joint arthroplasty and found that the three things that really mattered, almost in equal measure, were meeting expectation, achieving pain relief and the experience of healthcare delivery. No surprise food comes in for a lot of flak.

We can show we have improved the clinical outcome and are managing expectation better, but unfortunately our fractured care pathway has affected overall satisfaction. The environment in which patients recover, moving in the middle of the night to create beds is particularly effective at reducing satisfaction!

What to do now? As a basic minimum the Family and Friends test is valuable and covers all three domains that contribute to satisfaction (there are clear guidelines for this). To understand any differences a general Patient Reported Experience Measure (PREMs) and a specific PROMs measure are necessary and some patient demographics (gather co-morbidities and complications from the patient while you are there).

Patients love the contact, even the ones who complain thank you for the opportunity.

Good Luck!

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Appendix F

Reducing length of stay - NHS Fife

In NHS Fife the elective orthopaedic team had been focusing on reducing patient length of stay of all admissions from 2008, aided by the introduced of a weekend AHP service. We did a large audit of all patients, part of which identified the factors which were causing delays in discharge. We then looked for the solutions to overcome the main reasons for delay. This work helped as we moved forward with enhanced recovery.

We introduced the enhanced recovery of our patients having Total Hip Replacement in 2010 and Total Knee Replacements in 2012. We had several months of planning with a MDT group including all disciplines involved in the patients care. Our main challenges and tasks were:

- A change, for all staff, in the culture of how we managed our THR and TKR patients
- Consistent information to patients from pre-assessment to discharge home
- Discharge planning and follow-up
- Revamping our patient information to reflect enhanced recovery
- Invest more AHP (OT and PT) time in pre-assessment to prepare patients prior to admission. Education, use of equipment and walking aids
- Maintain the funding and staffing for AHP weekend working
- Post theatre exercises and mobility for patients medically fit to participate

The main factors which contribute to successful enhanced recovery of elective orthopaedic patients in NHS Fife are:

- Consistent team approach
- Well prepared patient
- Good post-operative pain relief, local and oral
- Early intervention to deal with post operative complications e.g. nausea, dizziness, wound soakage
- Early exercise and mobility programme
- Weekend AHP service
- Easy access to physiotherapy outpatient appointments for TKR for those patients it is assessed would benefit.

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