Optimal patient pathways for hip and knee arthroplasties: Use of Enhanced Recovery After Surgery principles - 2012

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 statistics quality assurance process but have been subject to the MSK Audit's own quality assurance process.

We report on a third 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** from 20th August 2012 to 30th September 2012 and data on knee arthroplasties from 1st October 2012 to 11th November 2012. 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 and April to June 2011.

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Summary of Key Findings and Recommendations

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). Although there is no precise definition of the elements of an ERAS pathway, this audit has measured the variables considered by the ERAS Orthopaedic Steering Group to be of most relevance (for example, patient education, standardised multimodal anaesthetic and analgesic regimens, early mobilisation and early independence, assisted by reducing urinary catheterisation and blood transfusion and by early removal of IV fluids and an early return to diet).

It is very encouraging to see the uptake of ERAS principles across Scotland. Individual units have developed their own ERAS pathways with varying emphasis on different elements to suit their own unique local situation. Units are encouraged to collect data locally to further improve their own programmes with the associated benefits for patients.

National Achievement in Two Years	2010	2012
Patients managed as ERAS patients	21%	59%
Same day admission	29%	46%
Urinary catheterisation	35%	19%
Blood transfusion	14%	6%
IV fluids stopped on day of surgery or <12 hrs post-op	22%	52%
Use of PCAs	49%	24%
Restarting diet on day of surgery or <12 hrs post-op	60%	78%
Mobilisation of patients by end first day post-op	84%	94%
Mean post-op length of stay (days)	5.6	4.9
Patients discharged by 3 days post-op	21%	35%
Patients discharged by 5 days post-op	62%	73%

See figures 8, 11, 22, 23, 21, 27, 28, 32 and 36 respectively.

The audit also looked at relationships between variables, both across hospitals and within hospitals. It is interesting to note that although relationships were found *across* hospitals (e.g. hospitals with lower use of PCAs 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 a PCA, compared to those patients in the same hospital who did use a PCA). Although this audit was neither designed nor powered to test such relationships, this finding supports the assertion 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 7) and have remained largely unchanged over the previous 3 years.**
- **It is encouraging to see little evidence of 'cherry-picking' of patients for ERAS programmes and this audit indicates that all patients (including more complex patients) can benefit from an ERAS pathway (see Table 2 in the Outcomes section).**
- **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. Assessment of the seven factors identifies clusters of hospitals at the higher end of each scale. Where there are outliers it is a different hospital for different variables.**

Pre-op Education –

- **It is encouraging to see a further increase in the number of patients receiving information in a variety of different formats around the country (see figs. 9 & 10). The ERAS steering group has provided funding to develop a national patient information booklet template that will be made available to all boards to use.**

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

- **The rate of Same Day Admission has increased since 2010, driven in part by the HEAT target. This does, however, have the potential to impact on anaesthetic practice such as periods of fasting and fluid restriction and use of pre-medication.**
- **There has been little change 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 to be admitted on the day of surgery, or that it is not properly followed.**
- **48% of patients received pre-operative medication (see figs. 14 and 15). Patients admitted on the day of surgery were less likely to receive a pre-med than those admitted the day before surgery.**
- **Overcoming the fasting, fluids and pre-med challenges of same day admission will ensure a more efficient service whilst maintaining key ERAS principles.**

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 -

- **Units are encouraged to review the recommendations from the Scottish Antimicrobial Prescribing Group (SAPG) in July 2012, particularly if using flucloxacillin plus gentamicin (see fig. 17).**
- **Analysis was undertaken of the incidence and plausible causes for post-operative changes in renal function and specifically the use of gentamicin (see Outcomes section).**

Anaesthesia and Analgesia –

- **The ideal regimen balances good pain relief with safe and early mobilisation of the patient and an early return to normal function. It is encouraging to see that intra-unit standardisation has increased since 2010, with the associated benefits of being able to monitor 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 Infiltration Analgesia (LIA) or peripheral nerve blockade. Over the three years of this audit there has been a significant shift away from regional nerve blocks and IV opioids to LIA for both hip and knee arthroplasty (54% of patients now receive LIA compared with 17% in 2010 - 46% of hip and 57% of knee patients. See figs. 18, 26 and 27).**
- **See figure 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.**
- **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. 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. However, units that included more of their patients in an ERAS programme had a lower incidence of PONV (see figs 29, 30 & 31).**

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 developmental HEAT target of only 4 weeks wait for MSK AHP services by 2014/15, it is imperative that the need for outpatient therapy is reviewed and consideration given to how we best use a finite resource.**
- **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 –

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

Delay to Discharge –

- **It is reassuring to see that administrative reasons (e.g. delay in social services provision of requirements) does not feature particularly frequently (see fig 37).**

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, 10% became abnormal (<=60) post-op. See figs. 39 & 40 and associated text for analysis of statistical relationships and possible causes.**

Re-admissions within 28 days –

- **One of the core principles of ERAS is to improve patient outcomes and maintain safety, whilst reducing LOS. It is encouraging, therefore, to see a low rate of readmission across the majority of sites (see 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 would like more data on your own patients included in the audit, including analysis by anaesthetist or surgeon, or if you would like a visit to discuss the report in more detail please contact Kate.james@scotland.gsi.gov.uk

The ERAS Orthopaedic Steering Group – March 2013

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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	15	17	32	0 (0%)
Crosshouse	21	23	44	0 (0%)
BGH	19	17	36	4 (10%) [a]
DGRI	15	27	42	0 (0%)
Fife	55	46	101	3 (3%) [a]
Forth Valley	17	26	43	0 (0%)
Aberdeen	5	7	12	78 (87%) [b]
Elgin	19	18	37	0 (0%)
GRI	22	28	50	9 (15%) [a]
WIG	33	35	68	1 (1%) [a]
Victoria	-	-	-	23 (100%) [b]
SGH	7	10	17	22 (56%) [b]
RAH	17	29	46	12 (21%) [c]
Inverclyde	8	15	23	0 (0%)
GJNH	121	102	223	35 (14%) [a]
Raigmore	42	36	78	0 (0%)
Hairmyres	26	21	47	0 (0%)
Monklands	15	15	30	0 (0%)
Wishaw	17	15	32	0 (0%)
RIE	81	85	166	0 (0%)
Ninewells/Stracathro	52	30	82	2 (2%) [ad]
Perth	39	38	77	0 (0%)
Total	**646**	**640**	**1286**	189 (13%)

- *The audit included elective hip arthroplasty patients operated on between 20th August and 30th September 2012, and elective knee arthroplasty patients operated on between 1st October and 11th November 2012.*
- *To boost sample sizes, some sites with small numbers included additional hips in October (DGRI n=2, Elgin 4, Inverclyde 4, Monklands 1, SGH 1) and additional knees in August and September (Elgin n=11, Inverclyde 8, Monklands 1).*
- [a] *Exclusions due to lack of access to casenotes, usually when these were held in offsite units.*
- [b] *Three units did not have Local Audit Co-ordinators in post during the audit period, but in two cases (Aberdeen and SGH) the units collected a limited number of casenotes for investigation on a single visit by the national MSk Audit Clinical Co-ordinator. Data from Victoria Infirmary could not be collected. Unfortunately the sample of casenotes made available from Aberdeen and SGH (particularly Aberdeen) was small, but may still give a very rough indication of current ERAS management. The number of patients excluded at Aberdeen was estimated from the number of records for the relevant period on ISD's SMR01 database (data extracted in March 2013, but note that Grampian's overall SMR01 data for the knee audit period was estimated to be only 75% complete at the time of extraction, so the number excluded could potentially be higher).*
- [c] *A number of RAH patients were excluded due to staff leave. Patients originating from Oban were not audited.*
- [d] *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 21 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 nor powered to test such relationships, this finding supports the assertion 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.

As indicated on Table 1, two units' patients were sampled rather than audited in full (Aberdeen, 13% sample available; SGH 44% sample available). As the sample sizes from these units were so low (12 and 17 patients respectively), the resultant data for Aberdeen and SGH should be treated as indicative rather than representative of the true picture in these hospitals. In the case of Aberdeen, the absolute number of missed patients was particularly high (n=78+). Unadjusted use of Aberdeen's small sample size in the calculation of a national rate may have skewed the estimation of the use of ERAS concepts across Scotland as a whole in 2012. As Grampian had not implemented its ERAS programme at the time of auditing, we therefore assumed no change at Aberdeen since 2011 and used Aberdeen's 2011 data when calculating overall national 'All sites' statistics for 2012 (final column on each figure).

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 (76%) (Figs. 1 & 2). For the first time data was collected on BMI and deprivation. This demonstrated that only 15% of arthroplasty patients were of normal BMI with 35% classed as overweight and the remaining 50% 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 previous years, 25% of patients within this audit had one or more of six specific recorded co-morbidities. We extended this data collection in 2012 to include any other significant medical condition relevant to the patient's care, amounting to an additional 11% of patients (Fig. 5). The combined 36% of patients who had co-morbidities included 1% who had a neuromuscular disorder, 3.5% who had Inflammatory Joint Disease, and 3.4% who had chronic kidney disease. Pre-operative serum creatinine and haemoglobin levels were also collected (Figs 6 & 7).

Figs. 1-7 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. Assessment of the seven factors identifies clusters of hospitals at the higher end of each scale and where there are outliers it is a different hospital for different variables.

In addition, it is encouraging to see little evidence of 'cherry-picking' of patients for ERAS programmes. There was no evidence that ERAS patients differed in age, ASA, BMI, number of co-morbidities or deprivation compared to those not treated as part of an ERAS programme. There was a tendency, however, for ERAS patients to be less likely to have a pre-operative abnormal Hb (12% v 16%, p=0.07) or low (<=60) eGFR (10% v 13%, p=0.07). This audit indicates that all patients (including more complex patients) can benefit from an ERAS pathway. For example, see Table 2 in the Outcomes section that shows post-operative length of stay is shorter for ERAS patients in all age and co-morbidity groupings.

Fig. 1: Age

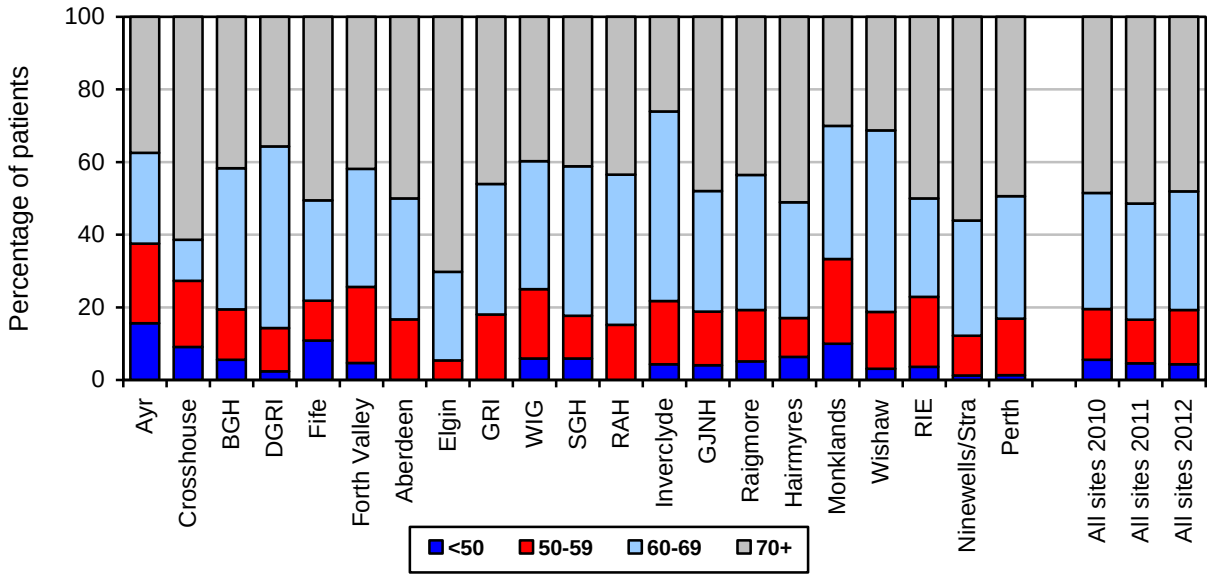


Fig. 2: ASA

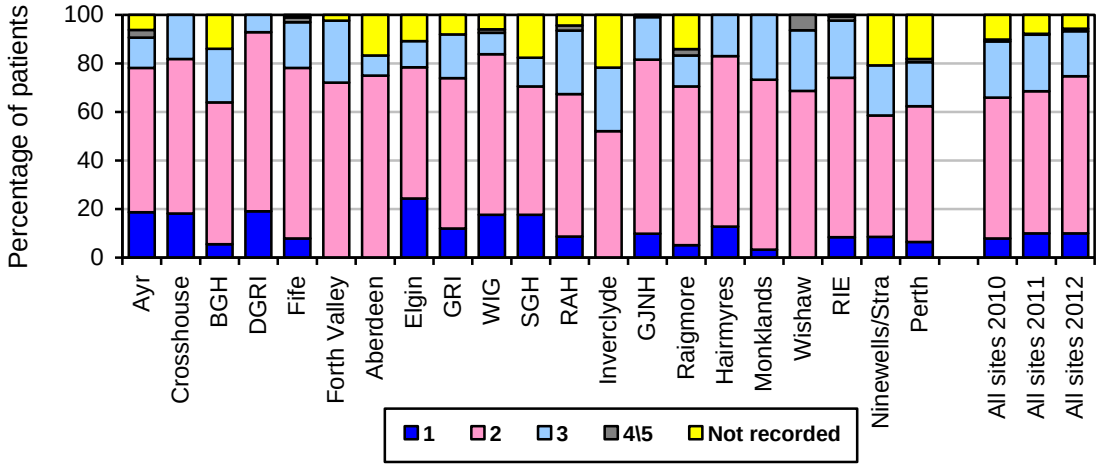


Fig. 3: BMI

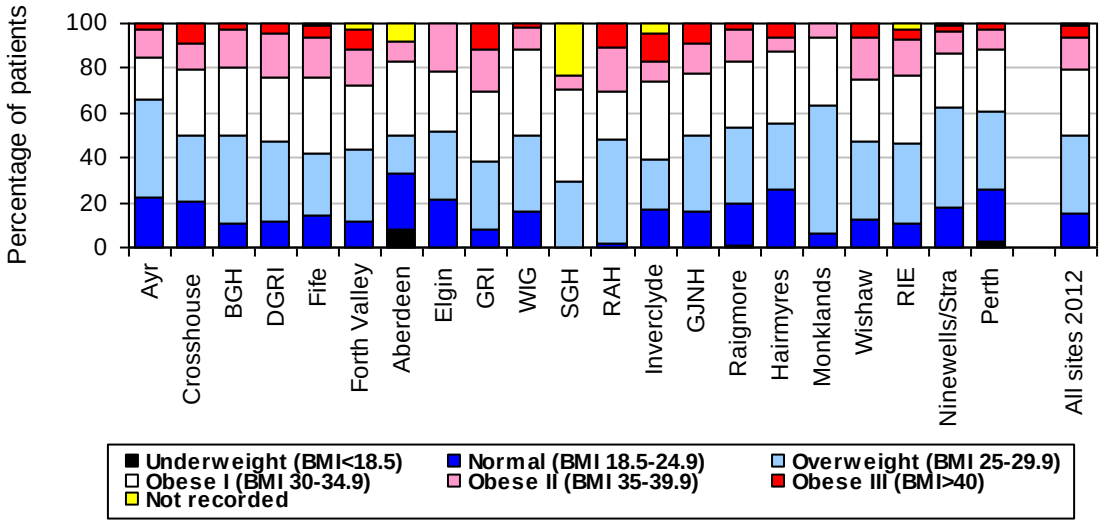
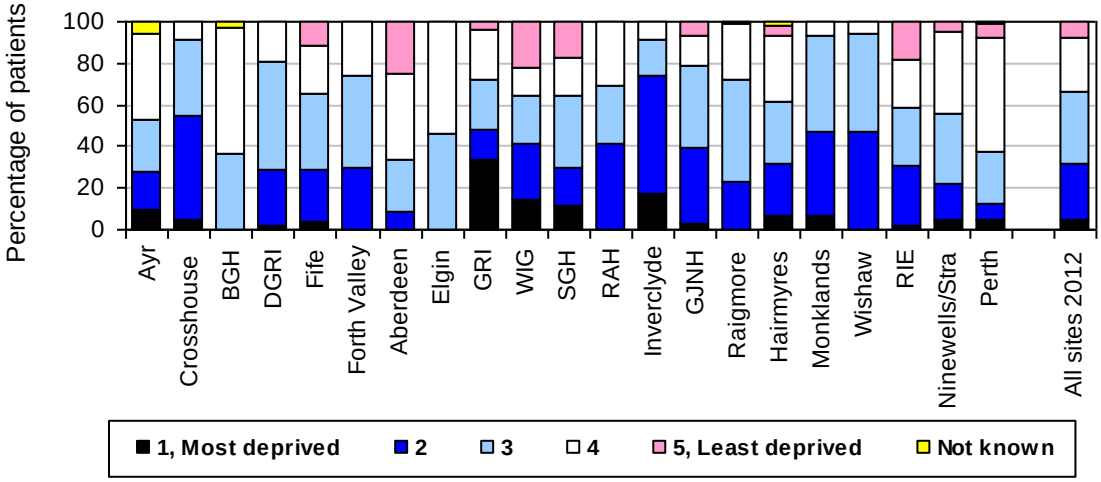
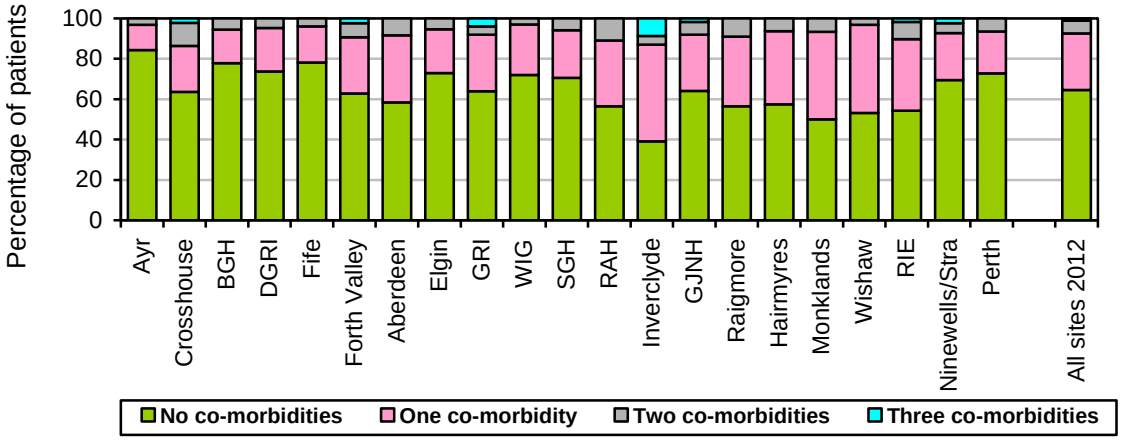


Fig. 4: Deprivation



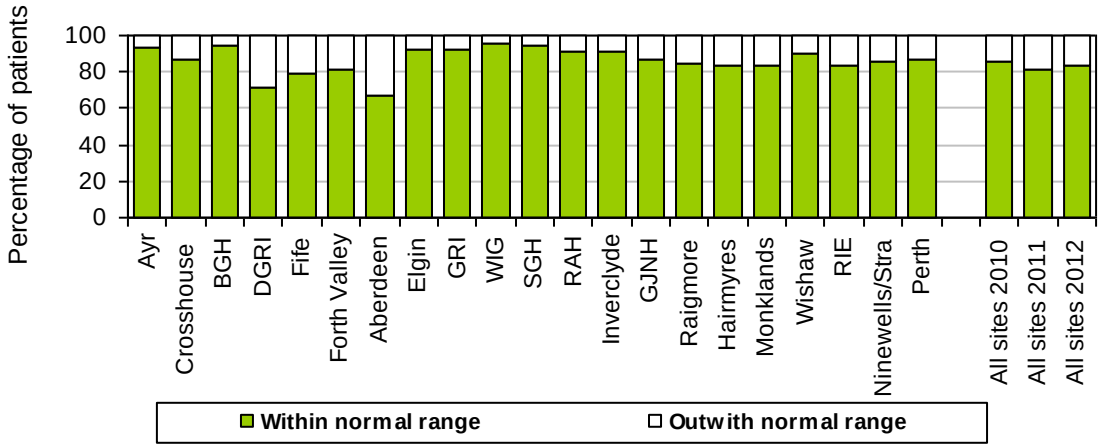
To ensure patient confidentiality issues during data processing, the MSk Audit only collects each patient's postal district data rather than full postcode (i.e. first 5 characters of postcode such as'MK5 6'). This precludes direct matching of the postcode data to the Scottish Index of Multiple Deprivation (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.

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



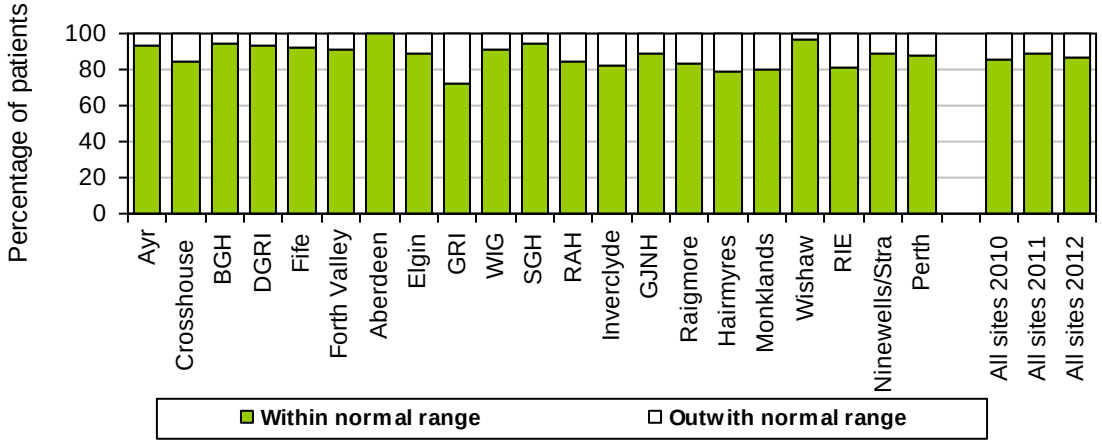
This information was found in the patients' medical clerking, pre-assessment or anaesthetic assessment sheets irrespective of time since diagnosis. In addition to the set of six co-morbidities we measured in previous years (IDDM, ischaemic heart disease, CVA/TIA, pulmonary embolism, LVF/CCF or COPD) in 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 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 definition.

Fig. 7: Pre-operative haemoglobin



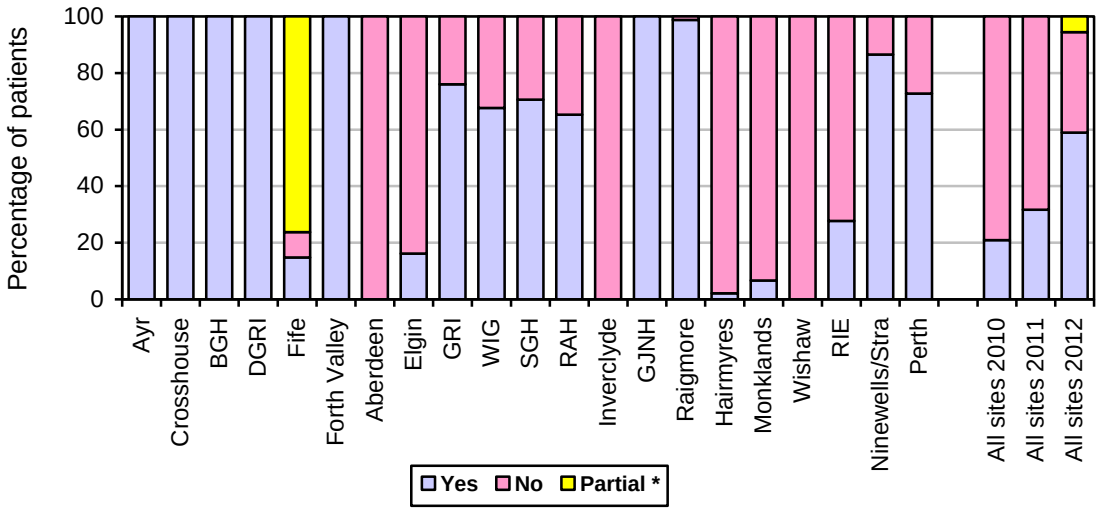
In 2012 we recorded absolute pre-operative haemoglobin level and defined levels of 115-165 for females and 130-180 for males as 'normal' levels. In contrast, in previous years 'normal' levels were taken as those defined as 'normal' by each unit and so may have differed to an unknown extent from the 2012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

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 the terms 'fast-track' or 'rapid recovery' - both 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. Last year's MSk ERAS report identified three important components following arthroplasty 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 three years. This change has been achieved by teams reviewing local care pathways and clinical evidence and sharing practice around Scotland.

Fig. 8: Was the patient treated as an Enhanced Recovery patient?



** NHS Fife - There is good evidence that the majority of NHS Fife patients are following an ERAS pathway from an Orthopaedic and Nursing perspective but that a variety of anaesthetic approaches are in use in terms of periods of fasting, restriction of oral fluids, use of PCAs and anaesthetic and analgesic preferences. The majority of Fife patients have therefore been classified as 'partial'.*

Since 2010 the number of patients being treated in Scotland as part of a local ERAS pathway has trebled with almost 60% now benefiting from improvements in local care pathways. Nine sites treat 75% or more patients as ERAS, and a further four sites treat 60-75% as such. The six units with less than 20% of patients being treated as ERAS are all due to start their local programme in early 2013 (Fig. 8).

It is very encouraging to see a national uptake in ERAS principles across every board in Scotland. This will continue to grow further and teams should continue their excellent work to develop their local programme fit for their own unique local situation. Individual units have developed their own ERAS pathways with varying emphasis on different elements. Units are encouraged to collect data locally to further improve their own programmes with the associated benefits for patients.

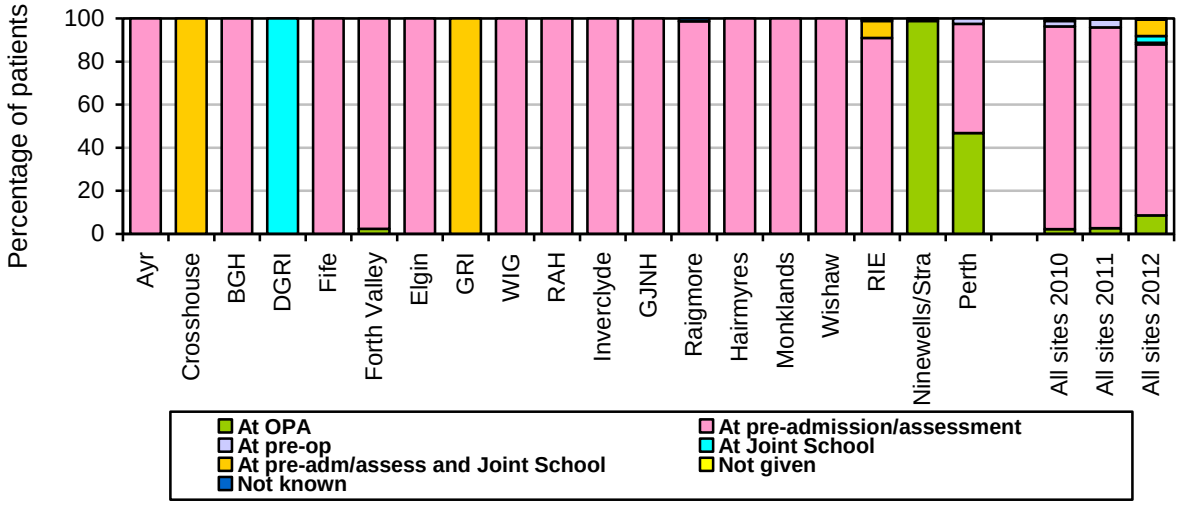
Pre-operative phase

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,). The 2011 MSk Audit ERAS report showed an association between provision of education and reduced length of stay. It is therefore encouraging to see a further increase in the number of patients receiving information in a variety of different formats around the country (Figs. 9 & 10). Joint schools, patient booklets, DVDs, or web-based sources of information are growing in popularity.

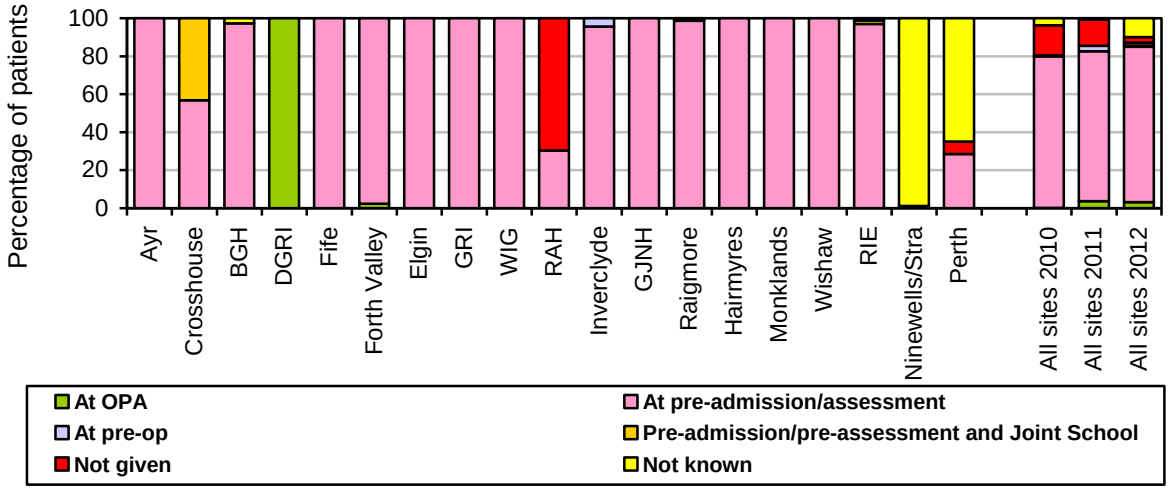
Developing written materials is time consuming. The materials require regular review to ensure they remain up to date. Many hospital sites have developed collaborations with commercial third parties, and although this can be beneficial in the short term, a number of sites report difficulties in continuing to update and fund the materials following initial promotional rates. The ERAS steering group has provided funding to develop a national patient information booklet template that will be made available to all boards to use as they wish. It is hoped that clinical teams will be able to 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. 9: Planned pathway: Verbal 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 we recorded this information separately.

Fig. 10: Planned pathway: Written information given



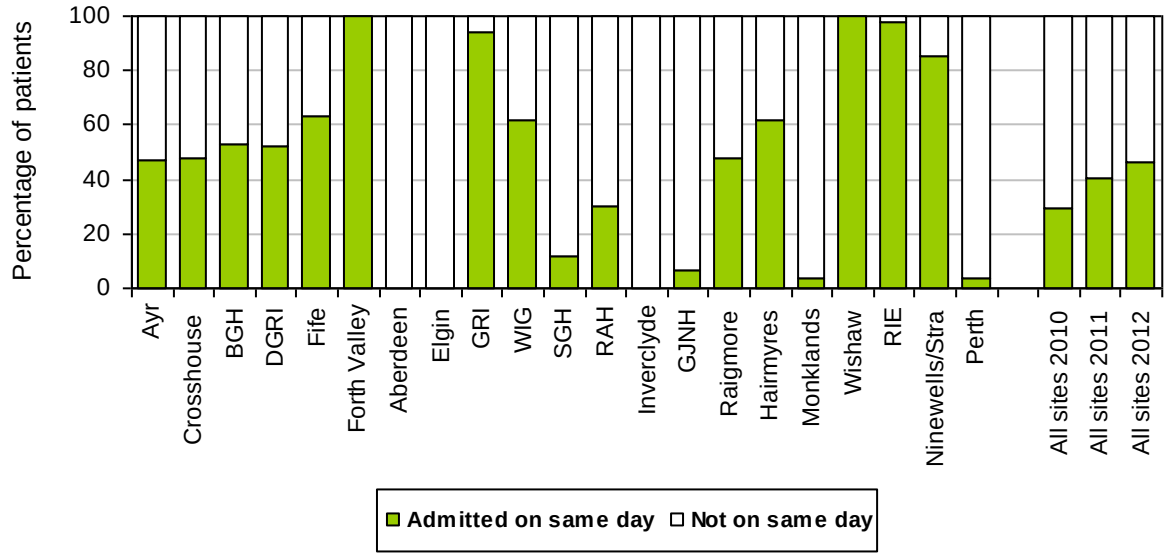
Note that in 2010 and 2011 if the patient attended a hip/knee 'school' this was recorded as pre-admission/ assessment, whereas in 2012 we recorded this information separately.

Admission to hospital

Same day admission of patients is increasing across Scotland, driven in part by the HEAT target. It does, however, have the potential to 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 by some 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 46% 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

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 little change 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. 73% of same day admissions had been fasting more than ten hours compared to 35% of previous day admissions. Only ten percent of same day admissions were given instructions to take clear oral fluids until two hours before surgery compared to 39% 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 two 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

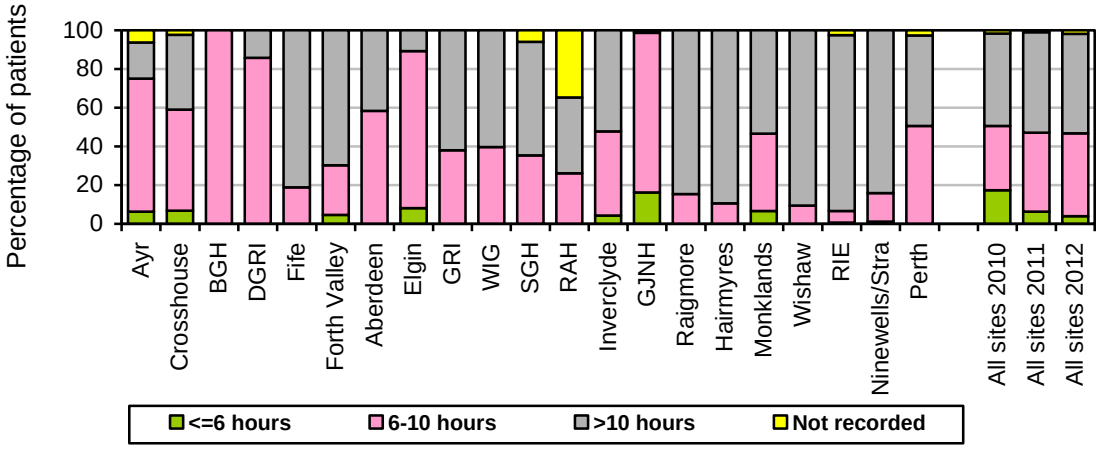
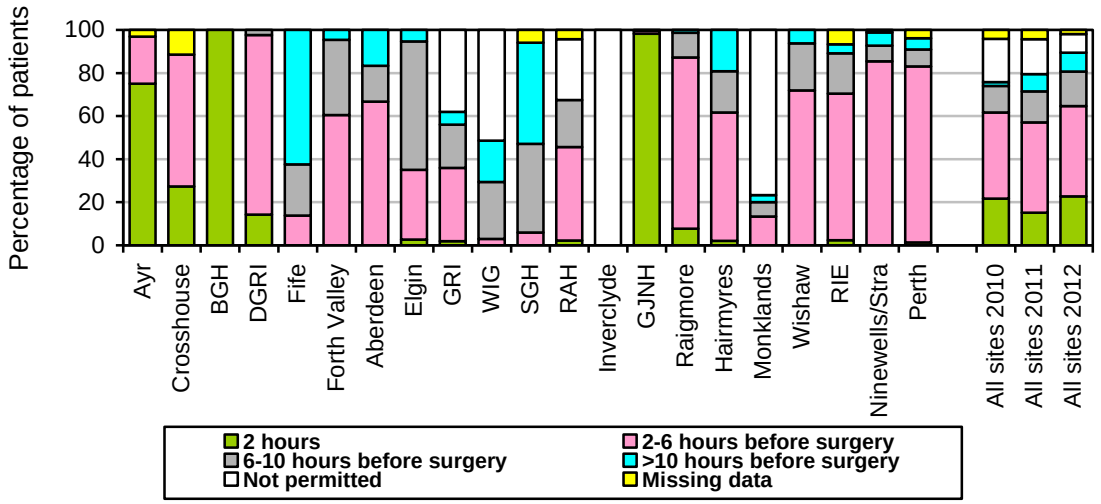


Fig. 13: When were clear oral fluids stopped prior to surgery?

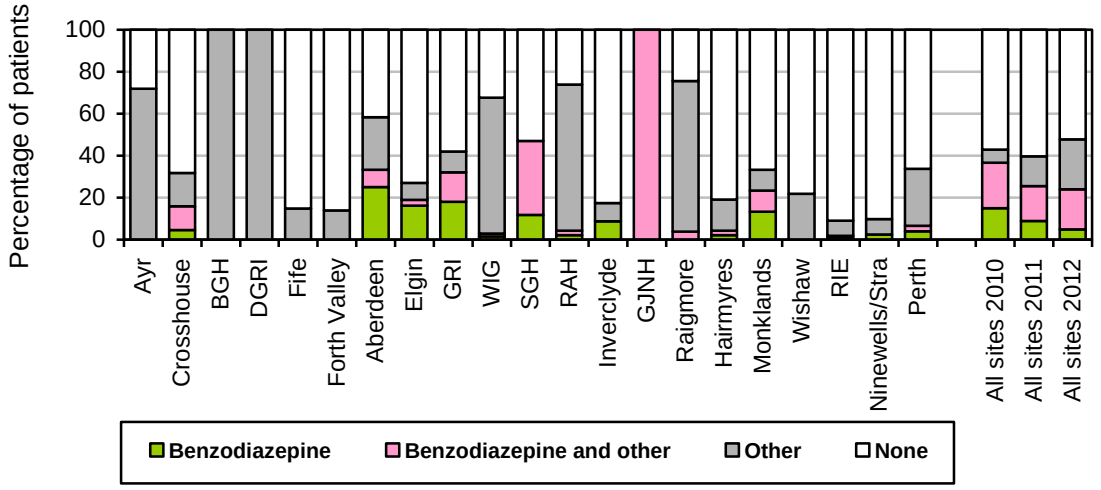


In some units there was a lack of clear documentation to the exact timing of oral fluids being stopped.

Pre-medication

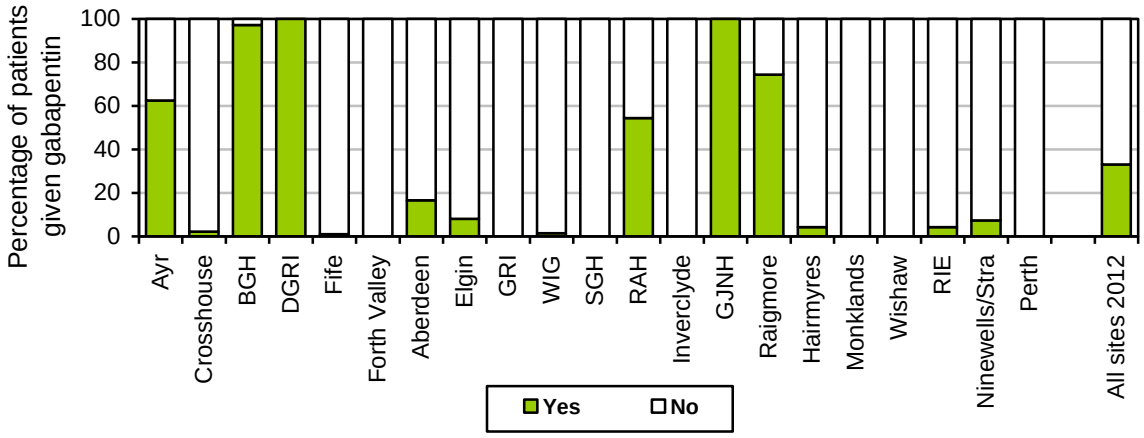
Multimodal analgesic regimens should ideally be commenced pre-operatively. This is not 'pre-emptive analgesia', but ensures good analgesia immediately following cessation of anaesthesia. Only 48% of patients received pre-operative medication (Fig. 14). 31% of patients who were admitted on the day of surgery were given pre-medication, compared to 66% of those who were admitted on the day before surgery.

Fig. 14: Type of pre-medication given



'Other' includes non-opioid and opioid analgesics, anti-emetics, gabapentin, ranitidine, etc. Note that gabapentin is included in the 'Other' category on Fig 14 for direct comparison with 2011 data, but is also shown separately on Fig. 15.

Fig. 15: Gabapentin given

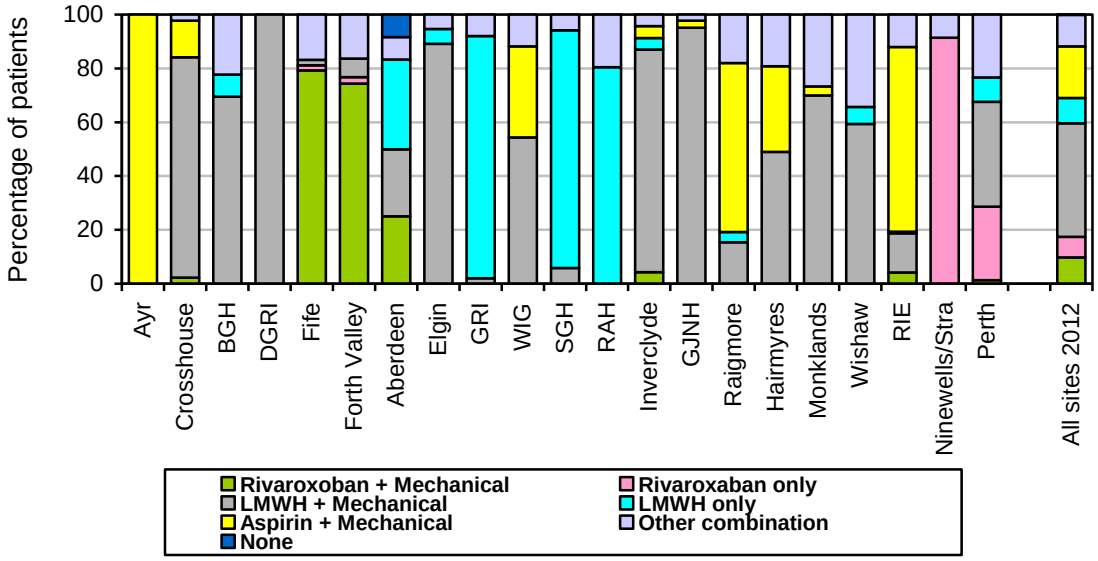


Gabapentinoids reduce post-operative pain and analgesic requirements in patients undergoing arthroplasty and many units now consider them a useful adjunct as part of a multimodal analgesic regimen (Fig. 15). However, although gabapentinoids appear to be better tolerated when used for post-operative pain 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

For the first time this year we recoded the type of VTE prophylaxis used at each site around Scotland. It is clear that there is no consensus (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: VTE 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

Antibiotic treatment

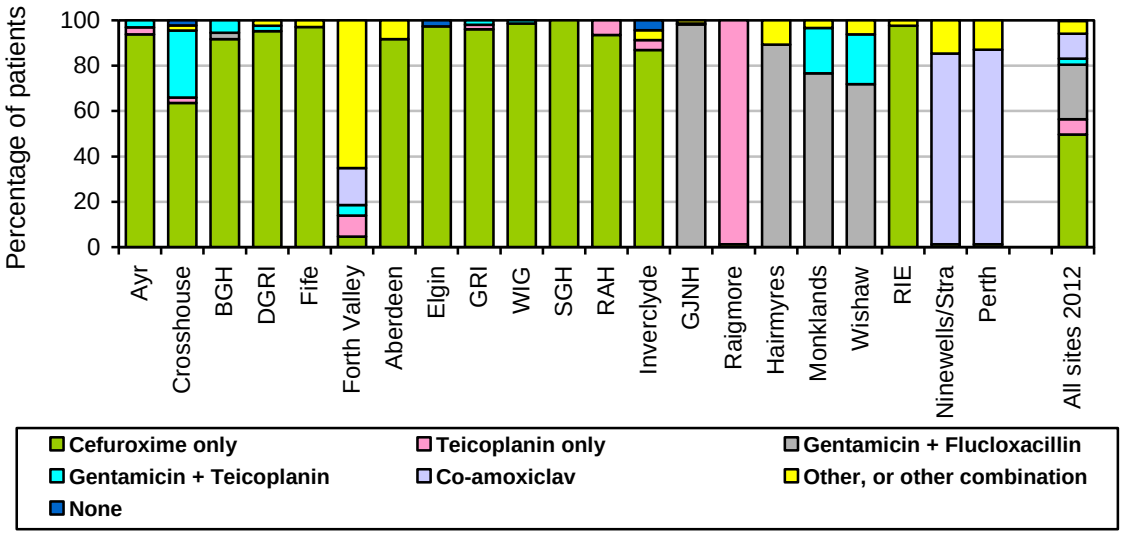
In July 2008, in response to increasing levels of *Clostridium difficile* infection (CDI) in Scotland, the Scottish Antimicrobial Prescribing Group (SAPG) issued guidance to NHS Boards advising use of flucloxacillin plus gentamicin. In 2011 several NHS Boards reported clusters of cases of Acute Kidney 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



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

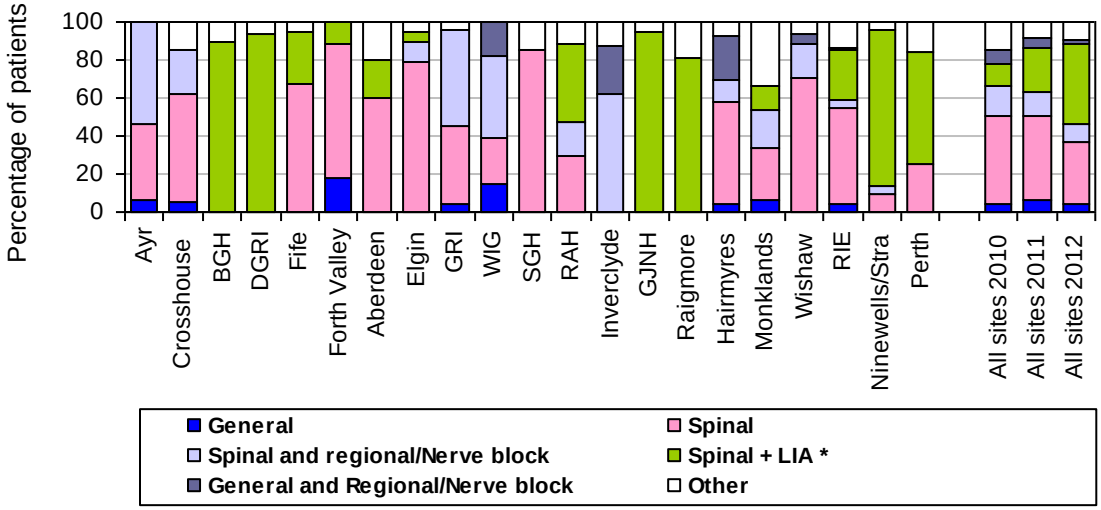
Anaesthesia

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 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 (54% of patients now receive LIA compared with 17% in 2010; Fig. 18).

The ideal anaesthetic regimen will enable safe and early mobilisation of patients with an early return to normal function. Although regimens vary between units, it is encouraging to see intra-unit standardisation of anaesthesia has increased over the past three 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.

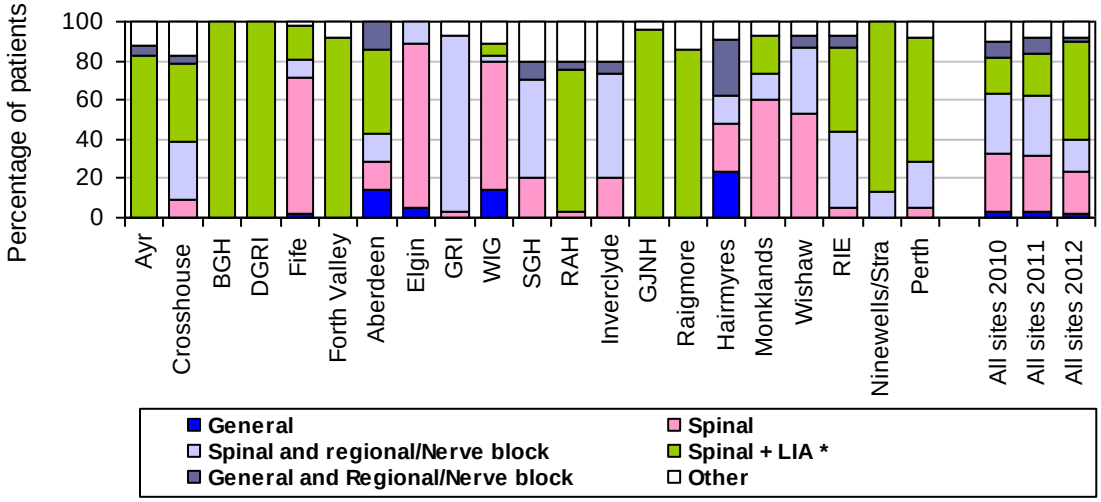
Fig. 18: Type of anaesthesia given

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.

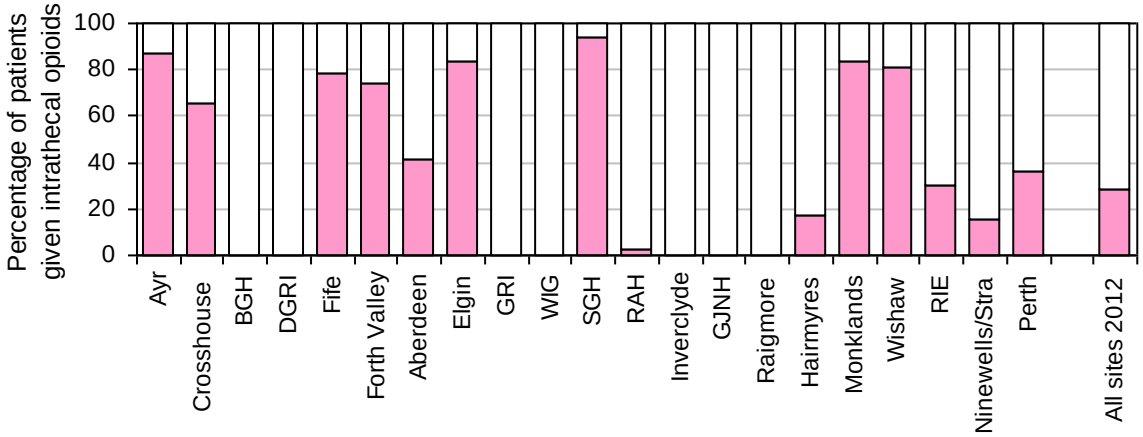
b) Knees



** 15% of Spinal+LIA knee patients also received a Regional/Nerve Block.*
In 2012 '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.

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 pruritus, 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, 26% were also catheterised, compared to 15% 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.

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 (Fig. 21). In addition, 92% of patient 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.

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

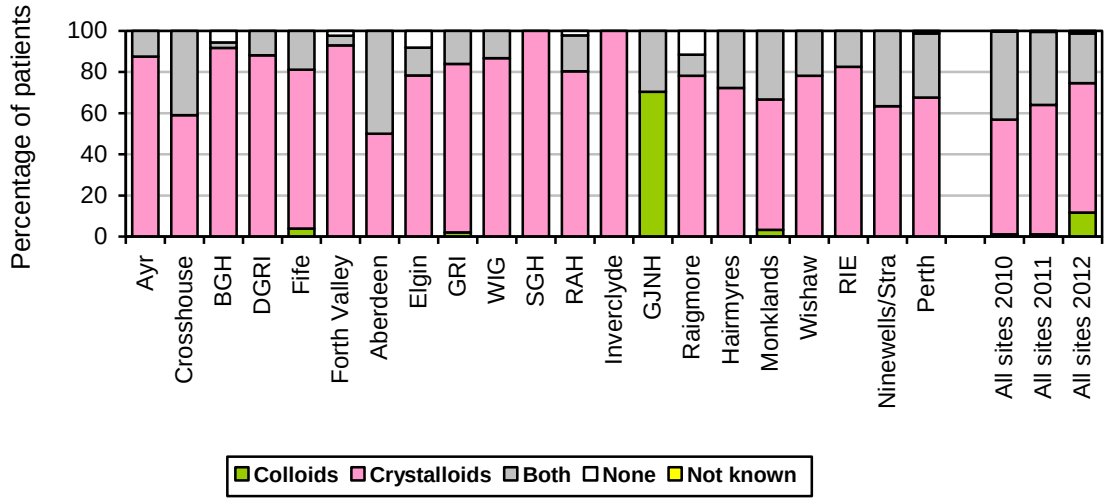
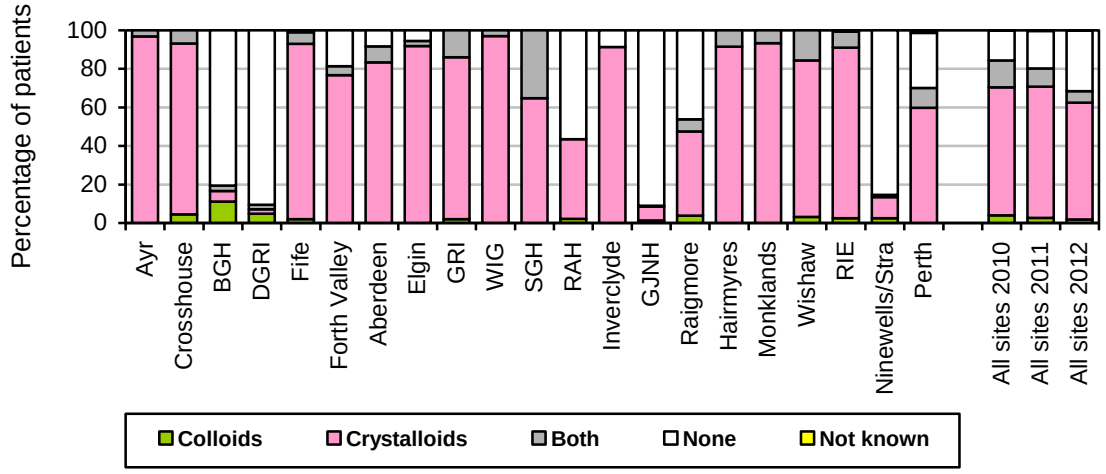
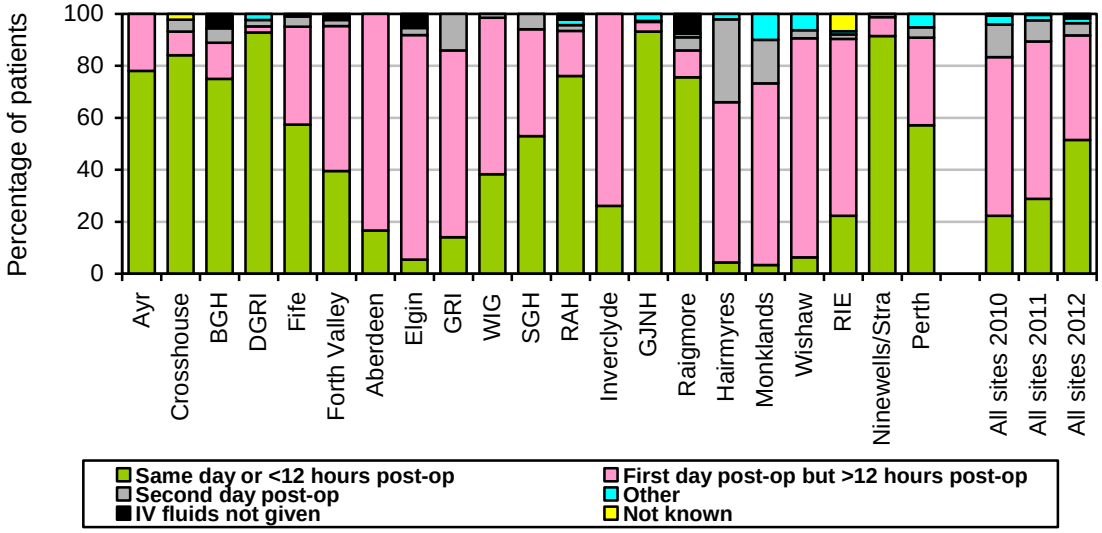


Fig. 20b: Type of IV Fluids - Post-op



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.

Fig. 21: IV Fluids discontinued

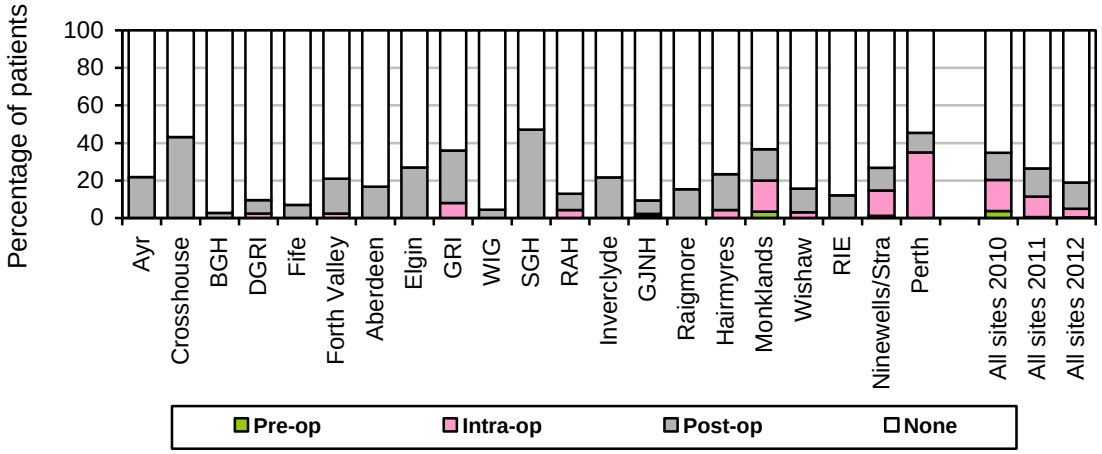


Some units have policies in place regarding discontinuation of IV fluids (providing this is clinically appropriate), e.g. some units stipulate that no patient should leave the Recovery Room to return to the ward with IV fluids in situ. For patients who are returned to the ward with IV fluids in situ, 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 three 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 19% in 2012 (Fig. 22).

Fig. 22: Patient Catheterised



During data collection it became apparent that there are local differences in criteria for post-operative urinary catheterisation. For example, Crosshouse routinely bladder scan every patient four hours post-operatively if they have not yet passed urine and will give careful consideration to early catheterisation if the residual volume is more than 500 ml, and all other methods of encouraging voiding have failed. In most other units, urinary catheterisation for post-operative retention is based only on clinical assessment, without recourse to bladder scanning, so this may in part explain some of the difference seen. Early catheter removal is desirable.

Blood Transfusion

Blood transfusion following arthroplasty in Scotland has seen further reductions for both hip and knee arthroplasty. Since the first MSK audit in 2010 the blood transfusion rate has fallen from 19% to 9% following THR and from 9% to 3% for TKR (Fig. 23). Units are encouraged to ensure optimum pre-admission Hb levels to reduce the need for pre-operative transfusions.

Fig. 23a: Patient Transfused - Hips

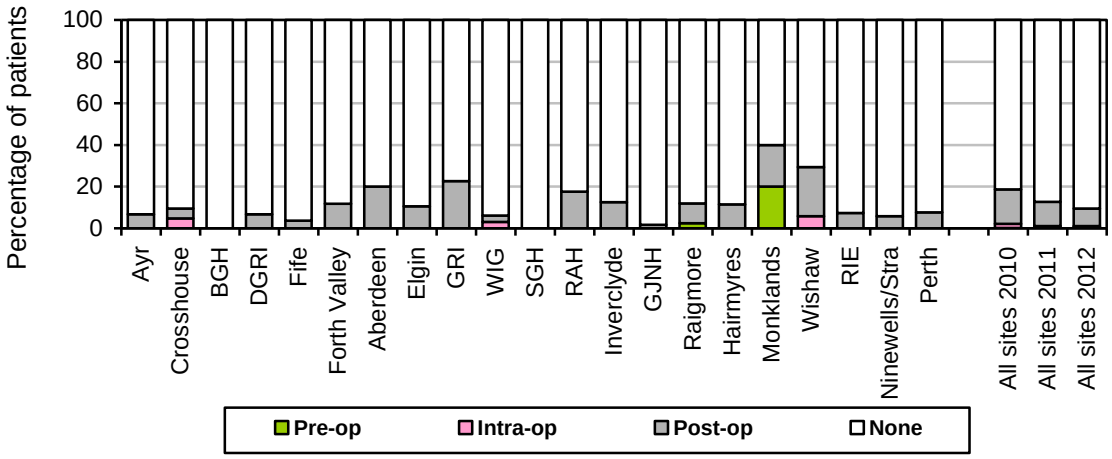
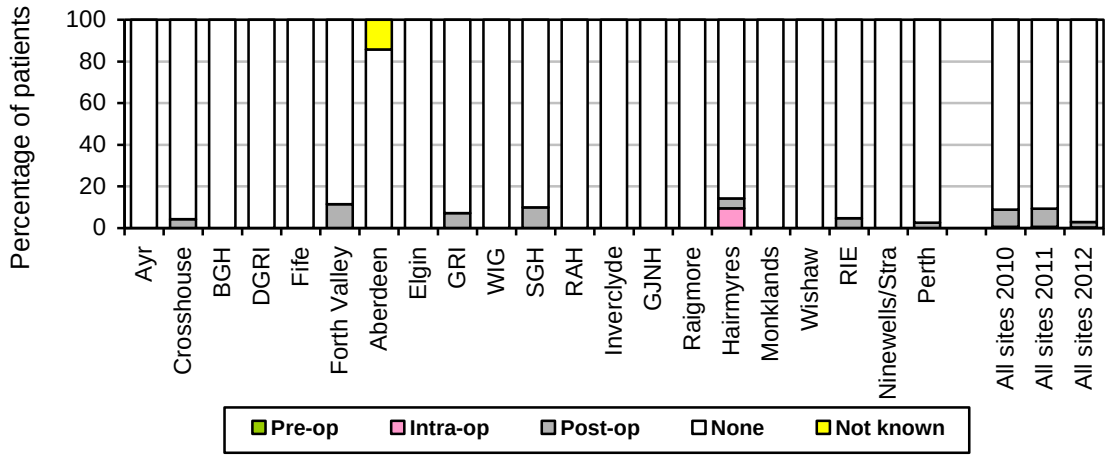


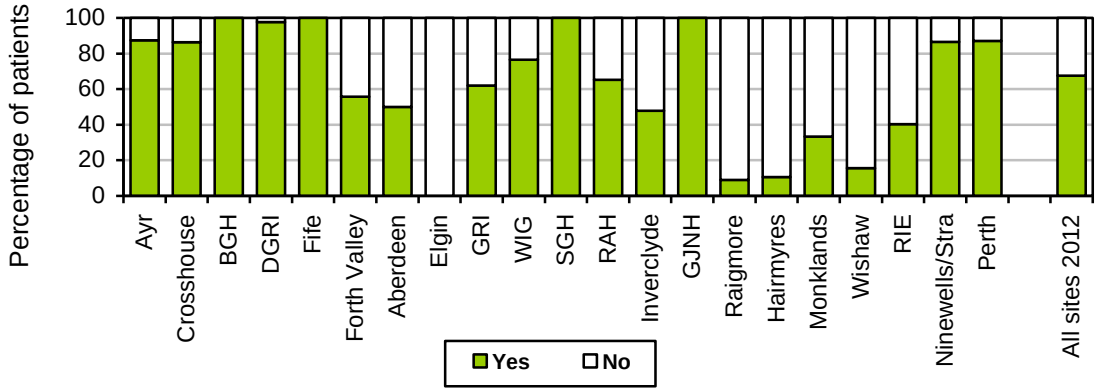
Fig 23b: Patients Transfused - Knees



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. We recorded the use of tranexamic acid for the first time this year (Fig. 24): 68% of patients in Scotland received this as part of their intra-operative management.

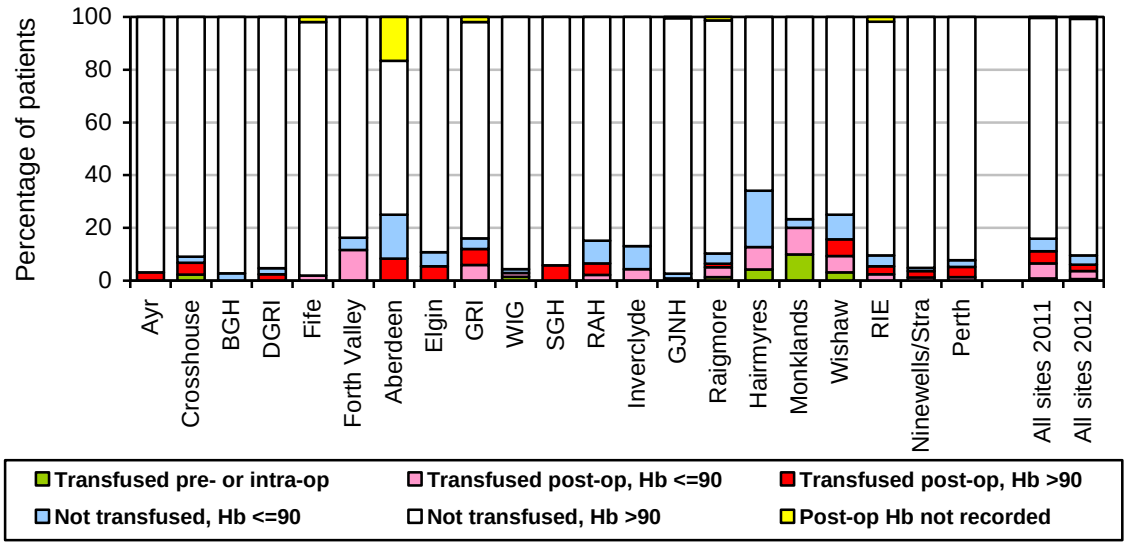
Only 3% of patients who had been given tranexamic acid were given an intra- or post-op transfusion, compared to 11% of those who were not given tranexamic acid. In seven units with a sufficient sample size that used tranexamic acid on some but not all patients the transfusion rate dropped by between 4% and 28% if tranexamic acid was used, from an average of 16% in patients not given tranexamic acid to 3% in those given tranexamic acid (p=0.02).

Fig. 24: Use of tranexamic acid



Over the last year there has been a reduction in the number of patients with post-op Hb > 90g/dl receiving a blood transfusion (Fig. 25). This is encouraging. Continued education of trainee medical staff and other staff groups is required to sustain this improvement. Scotland now has an overall transfusion rate of 6% for hip and knee arthroplasty.

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



Post-operative phase

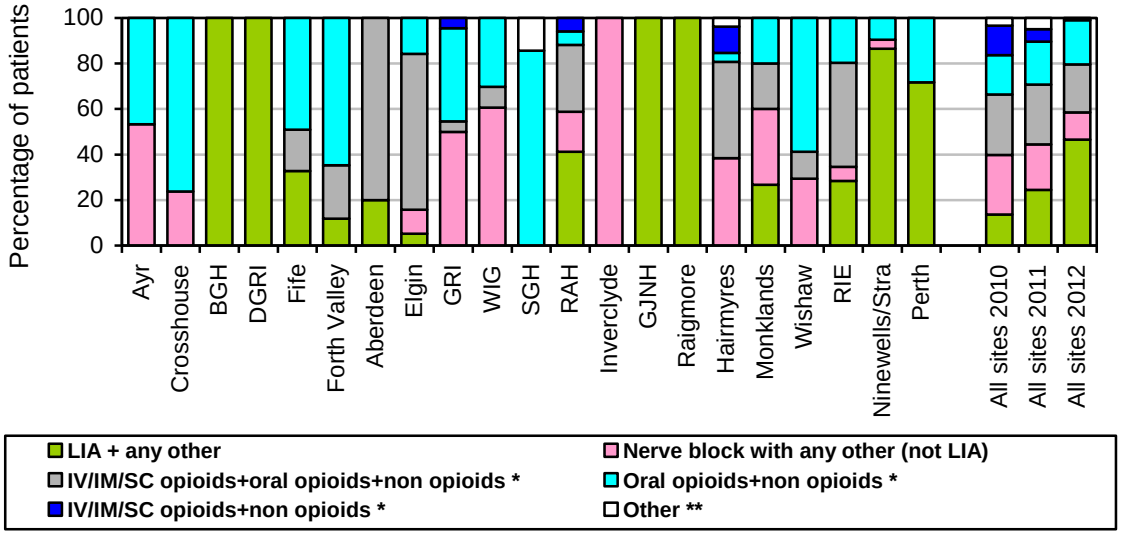
Analgesia

Within the past three 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.

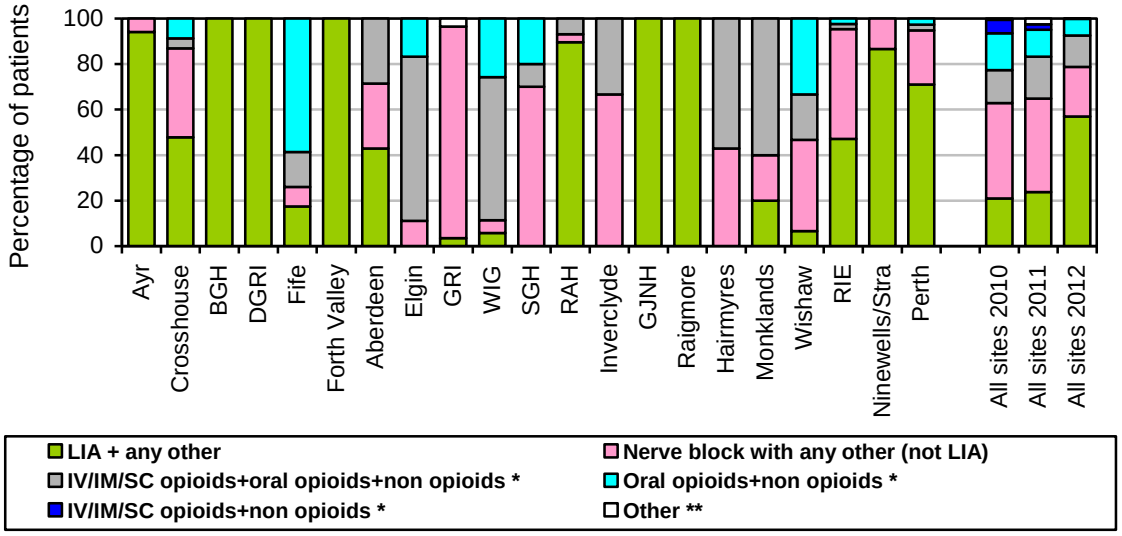
There has been a clear shift away from IV opioids for both hip and knee arthroplasty (Figs. 26 & 27). LIA continues to grow in popularity with 46% of hip patients and 57% of knee patients receiving it as the primary method of post-operative analgesia with a corresponding reduction in regional nerve blockades. 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

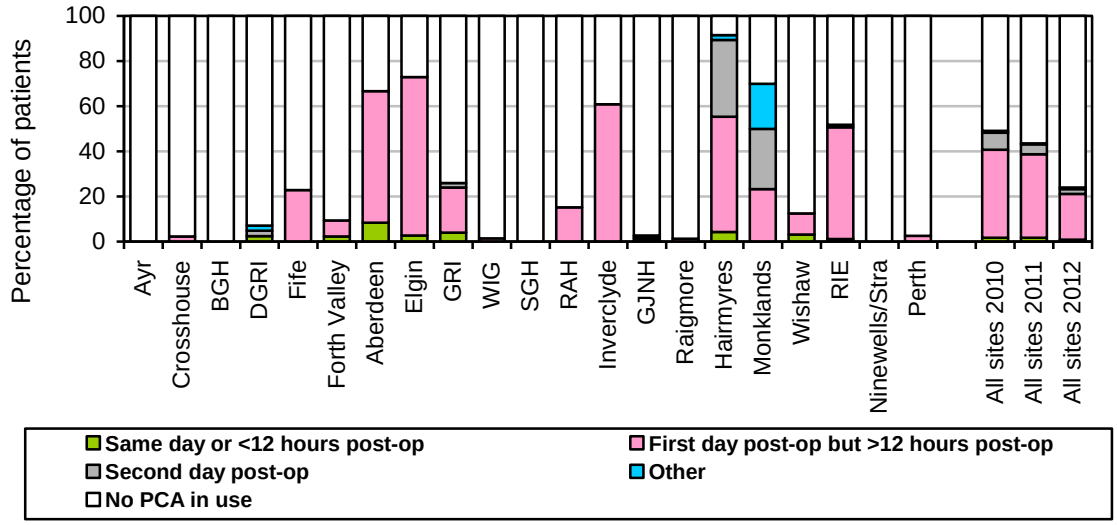


b) Knees



* 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

Fig. 27: PCA discontinued



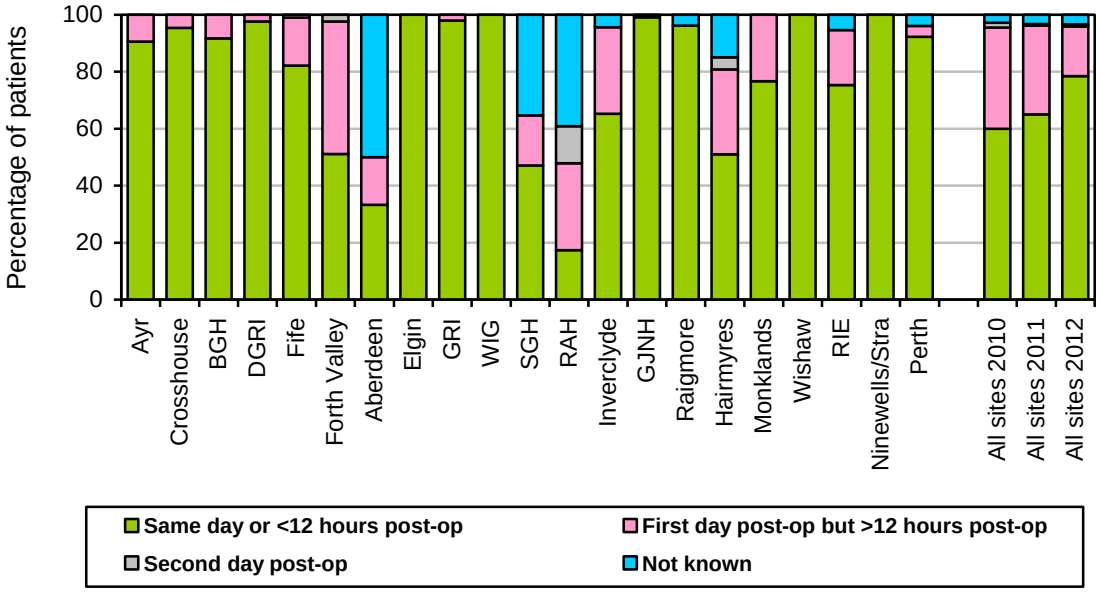
There has been a significant reduction in PCA use following arthroplasty surgery, from 49% of patients in 2010 receiving a PCA to 24% in 2012 (Fig. 27). As per previous reports, hospitals with lower usage of PCA morphine also had higher same day mobilisation rates and lower post-op LOS. However, it is 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 78% in 2012 (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 (77% versus 90%), and this relationship held 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 (p=0.03).

Fig. 28: Diet recommenced



Post-operative nausea and vomiting and use of prophylactic anti-emetic medication

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 (Fife, Wishaw, and Perth) only record PONV when a PCA is in use, and others do not record PONV at all (DGRI, Hairmyres and Monklands) (Fig. 29). After excluding these hospitals' data, and a further 7% of data from patients where full data for the first 48 hours was not available, 33% of patients had some nausea and vomiting during the first 48 hours after surgery (varying from 3-58% 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

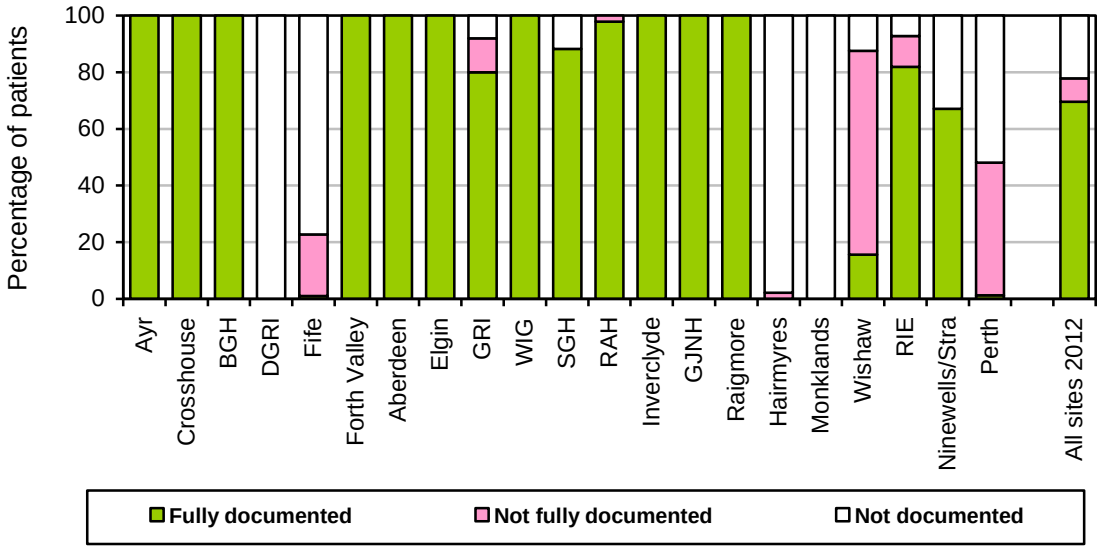


Fig. 30: Maximum PONV score recorded during the first 48 post-op hours

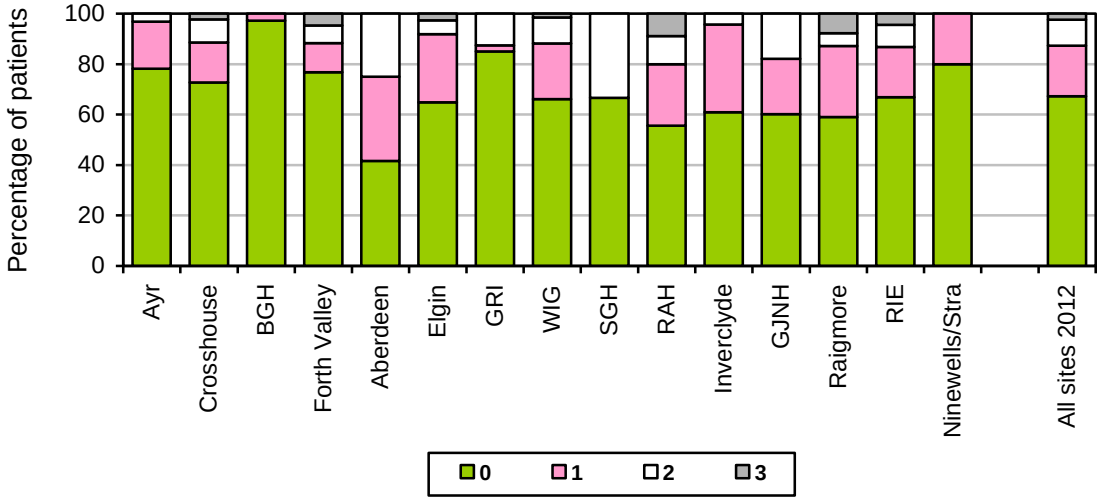
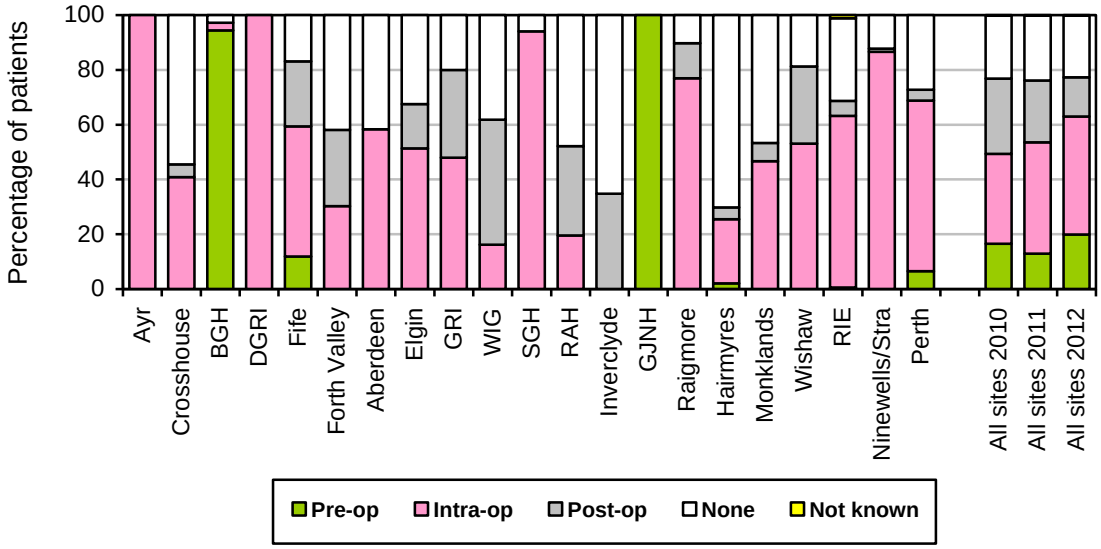


Fig. 30 only includes data from patients with full documentation during the first 48 post-operative hours.

Fig. 31: Time first prophylactic anti-emetics administered



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, units that included more of their patients in an ERAS programme had a lower incidence of PONV over the first 12 hours (17% for all ERAS patients vs 27% non ERAS; tested across 15 hospitals, p=0.007) and over the 48-hour period (31% vs. 39%; tested across 15 hospitals, p=0.04). This could be due to such factors as use of multimodal analgesia and prophylactic anti-emetic prescribing.

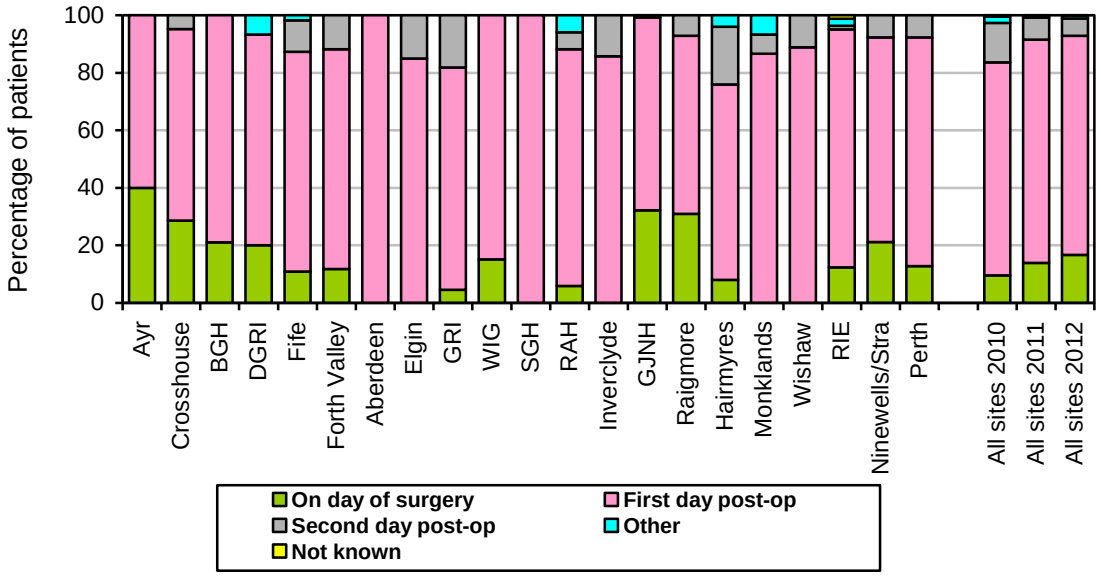
Prophylactic administration of anti-emetics (either intra-operatively or early and regular post-operatively) is likely to be more effective than early therapeutic administration.

Mobilisation (up to stand/sit)

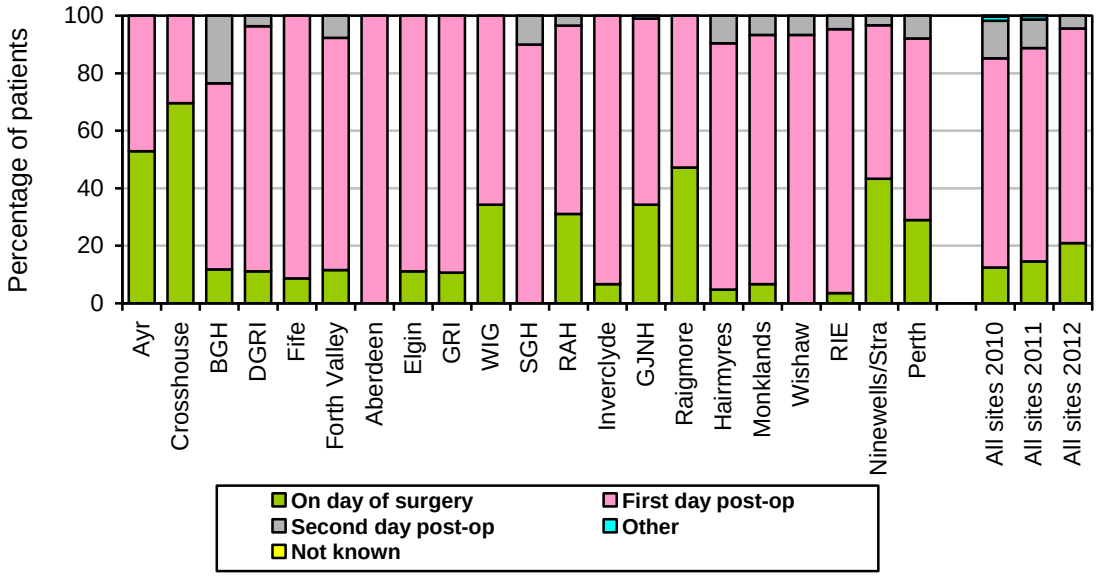
Hospitals should be encouraged to aim to mobilise all patients, with a few exceptions for medical reasons, within 24 hours of surgery. Nationally, the proportion of patients mobilised on the same day as surgery, or by the next day, continues to increase (Fig. 32). Units that included more of their patients in an ERAS programme had higher same-day mobilisation rates (p<0.001).

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

a) Hips



b) Knees



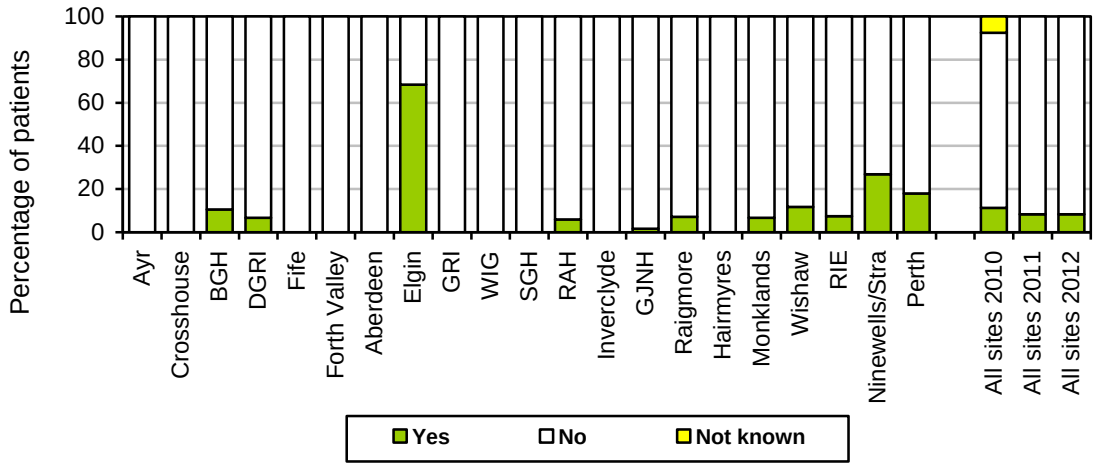
Post-Discharge Physio

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

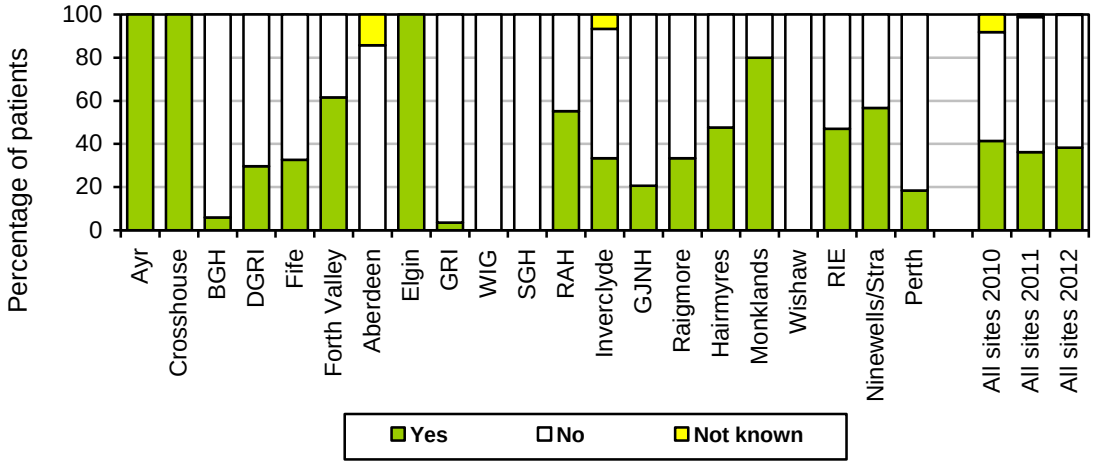
With the continual demand on MSK services, and the new developmental HEAT target of only 4 weeks wait for MSK AHP services by 2014/15, it is imperative that the need for outpatient therapy is reviewed and consideration given to how we best use a finite resource. Interestingly a number of internet-based 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



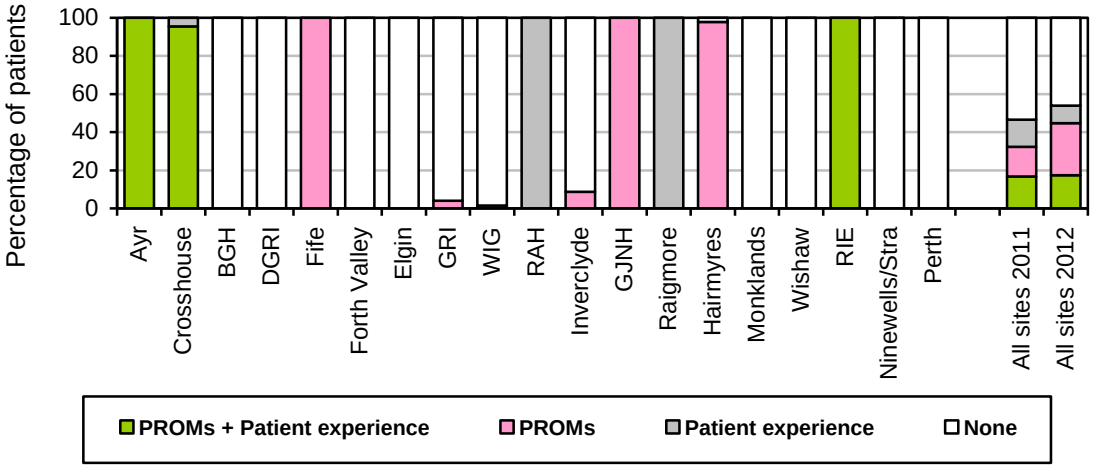
b) Knees



Patient experience

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

Fig. 34: Methods of measuring patient experience



Data were not collected at Aberdeen or SGH

Outcomes

Length of Stay

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

Mean post-op length of stay also continued to fall, from 5.58 days in 2010 to 5.22 days in 2011 and 4.88 days in 2012 (significance for hospital level tests: 2010 to 2011, p=0.007, 2011 to 2012, p=0.025). In 2012, the median post-operative length of stay was 4 days for both hips and knees. 37% of patients are now discharged within three days of surgery with 73% of patients within 5 days.

Units that included more of their patients in an ERAS programme had shorter lengths of post-operative stay (p<0.001). This reduction in post-operative length of stay appears to benefit all types of patient to a similar degree, whether younger or older or with more co-morbidities (Table 2).

Table 2: Post-operative length of stay in relation to age, co-morbidities and ERAS

	Mean post-op length of stay (days)		Difference	
	ERAS	**Non-ERAS**	**Days**	**%**
Age				
Under 50	3.6	4.7	1.0	28%
50-59	3.9	4.8	0.9	23%
60-69	4.0	5.3	1.3	34%
70-79	4.9	6.2	1.3	26%
80+	6.2	7.6	1.3	21%
Co-morbidities				
None	4.1	5.3	1.2	30%
One	5.0	6.1	1.2	24%
Two or more	6.9	8.0	1.2	17%
Total	**4.5**	**5.8**	**1.3**	**28%**

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

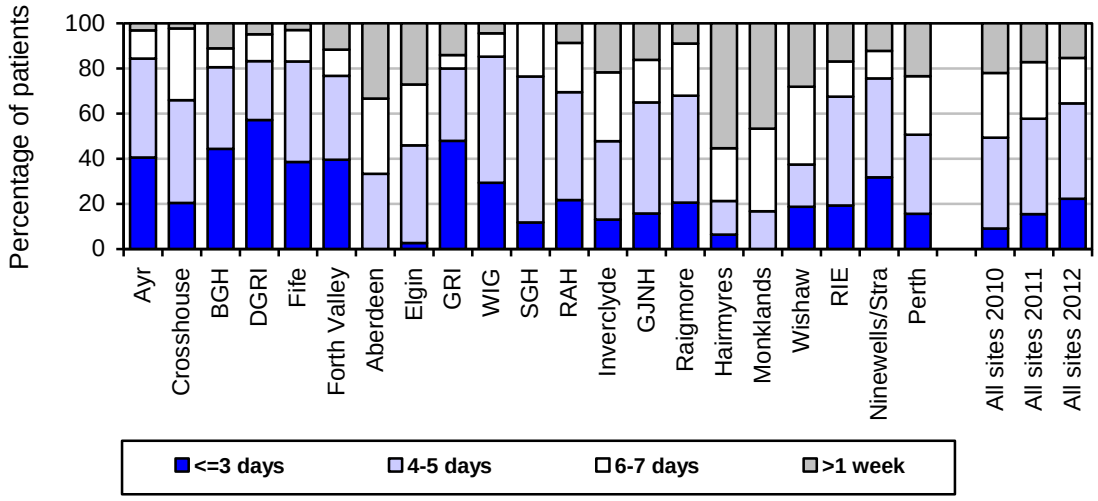
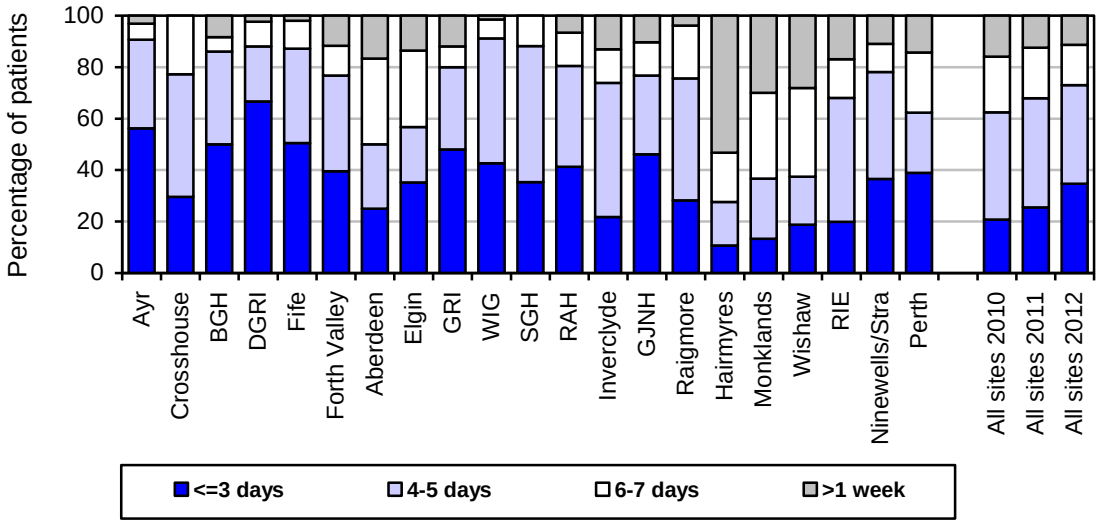
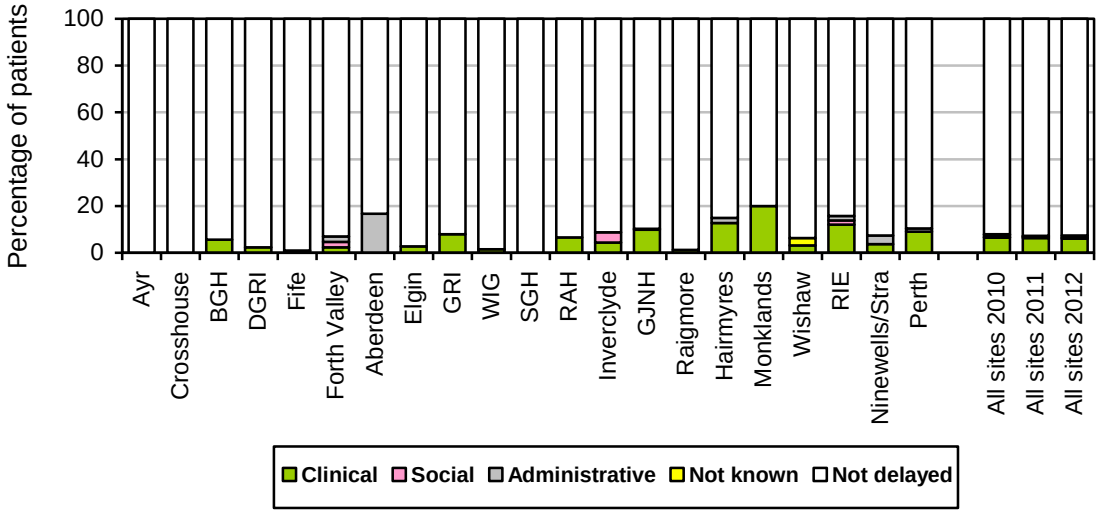


Fig. 36: Length of post-operative stay (date of operation to date of discharge)



We defined 'Delay to discharge' (Fig. 37) as documented evidence of clinical, social or administrative reasons clearly postponing the patient's discharge (Fig. 37). We did not class patients who may have been delayed briefly but were still discharged within 7 days as delays. Although many patients are given an Estimated Day of Discharge (EDD) at point of admission, they were not classed as delays if they exceeded their estimated length of stay purely for reasons such as 'slow to mobilise'.

Fig. 37: Delay to discharge

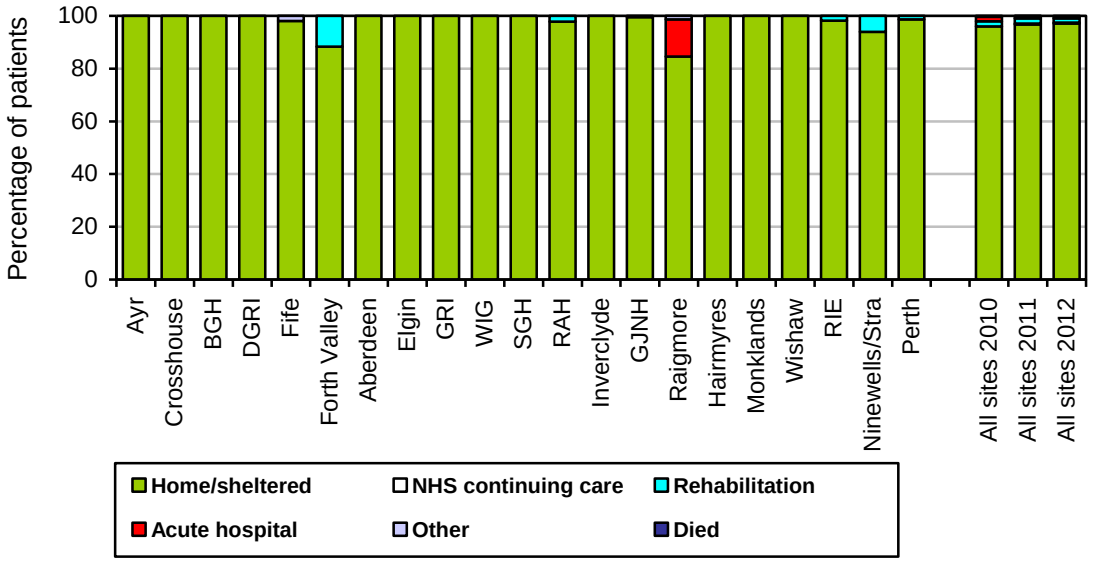


Patients who may have been delayed briefly but were still discharged within 7 days are included as 'Not delayed'

Of the 81 patients who were delayed for at least a week for clinical reasons, 3 were for wound infections, 5 for wound soakage, and 10 because of the Warfarin/anticoagulant regimen.

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, 10% became abnormal (<=60) post-op. This percentage increased with age, ASA and number of co-morbidities, and also varied between hospitals. A logistic regression model selected hospital, age and ASA as significant influences on whether normal eGFRs became abnormal. None of the other independent variables offered to the model (whether an ERAS patient or not, type of anaesthetic, type of analgesia, antibiotic prophylaxis – all categories, use of gentamicin specifically, type of premeds, time oral fluids were stopped, type of VTE prophylaxis) were significant (n=1120 patients for analysis, all p values >0.15). Other factors that may contribute to renal impairment such as use of NSAIDS or Ace Inhibitors were not measured in this audit.

Fig. 39: Pre-operative eGFR

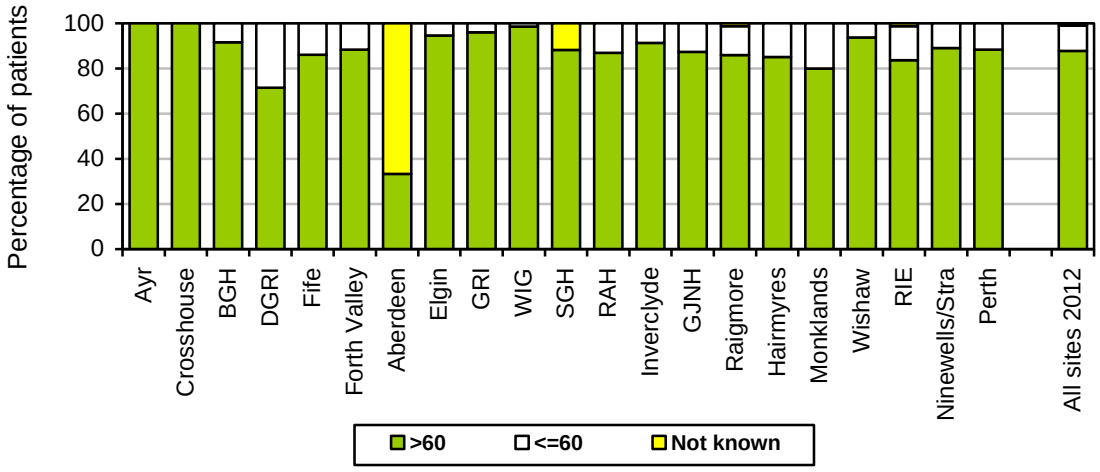
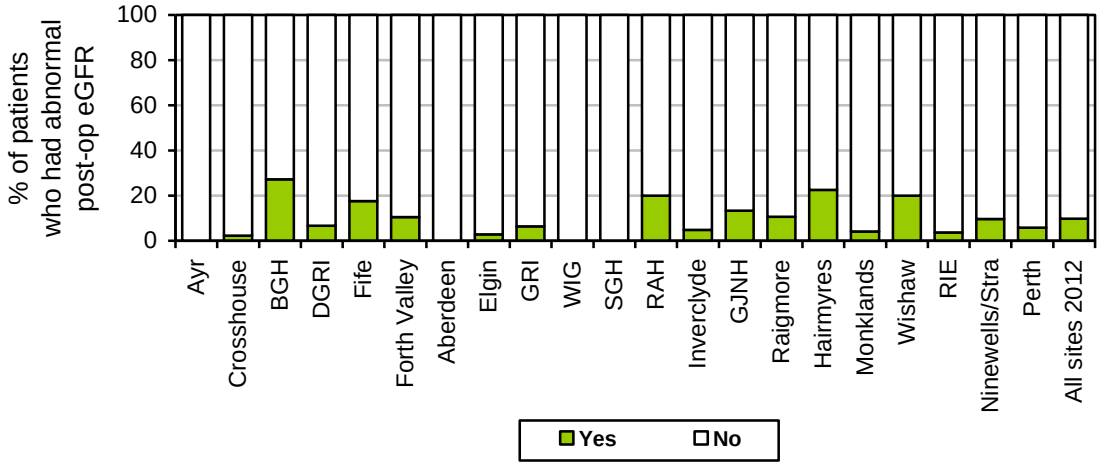


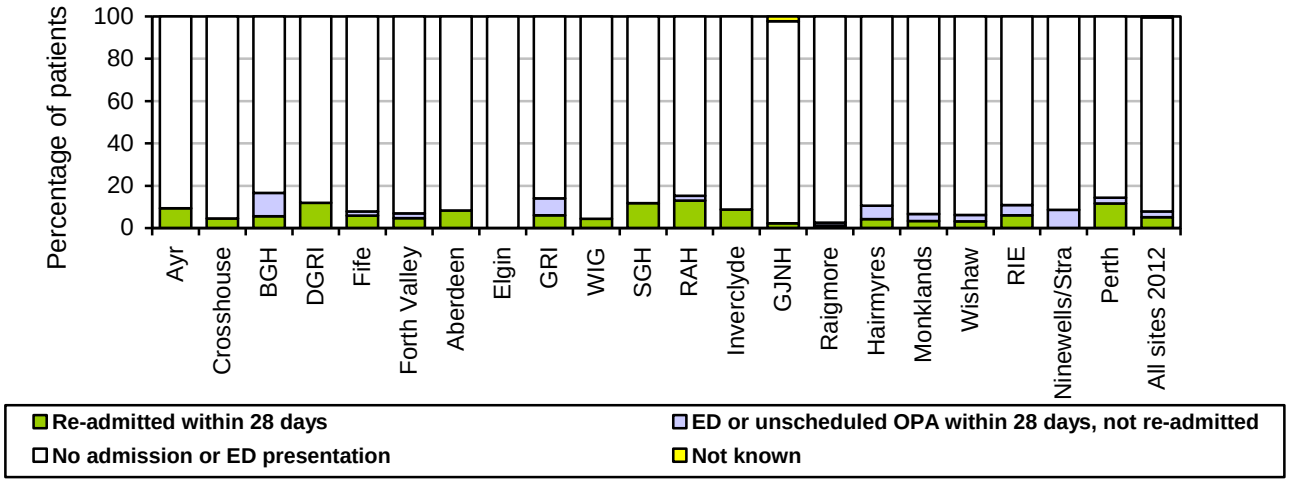
Fig. 40: Percentage of patients with normal pre-operative eGFR (>60) who had abnormal eGFR (<=60) post-operatively



Re-admissions within 28 days

We reviewed readmission data for all patients included in the audit. One of the core principles of ERAS is to improve patient outcomes and maintain safety, whilst reducing LOS. It is therefore encouraging to see a low rate of readmission across the majority of sites.

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



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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