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The National Comparative Audit of Surgery for Nasal Polyposis and Chronic Rhinosinusitis

Dr John Browne
Miss Claire Hopkins
Mr Rob Slack
Dr Jan van der Meulen
Professor Valerie Lund
Mr John Topham
Dr Barnaby Reeves
Ms Lynn Copley

On behalf of the British Association of Otorhinolaryngologists – Head and Neck Surgeons Comparative Audit Group and the Clinical Effectiveness Unit at the Royal College of Surgeons of England

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Foreword

Both the public and the profession expect surgeons to evaluate the results of their treatment. Comparative audit aims to provide a means for them to do so. It is seen as an important component of appraisal and revalidation for surgeons. Surgery for nasal polyposis and chronic rhinosinusitis was chosen for audit because it is commonly performed by a large number of otorhinolaryngologists. New techniques of surgery have been developed. We compare the results of traditional surgery with the newer endoscopic endonasal surgery. This study evaluates the factors which influence surgical outcome so that proper allowance can be made for case mix in assessing the results of different surgeons or units. Surgeons should be reassured that their reputations will not be harmed if they undertake to treat patients with more advanced disease.

Previous comparative audits have been criticised for failing to define the population of patients that they study and for failing to check the accuracy of their data. This audit has addressed both these problems. All patients during a six month period undergoing surgery for rhinosinusitis or nasal polyps were studied. Completeness and accuracy of data was ascertained by an independent researcher to inspect 10% of case notes and other data sources.

Audit needs well proven outcome measures. In this study patient symptom scores collected preoperatively have been compared with postoperative symptom scores. This method has previously been validated. Previous audits have shown that patients are more likely to provide postoperative feedback than individual surgeons. Long-term follow up of this patient cohort should enable us to assess the rate of recurrence of nasal polyps or the relapse of sinusitis. As with many surgical procedures there is a need for evidence to underpin current practice. This audit should provide data on the effectiveness of sino-nasal surgery.

The lack of central funding to support comparative audit was a major problem for this project. It was bypassed by approaching individual Trusts for funding. Unfortunately some Trusts that would have welcomed the opportunity to participate were unable to afford the cost of doing so. It is to be hoped that future audits will receive adequate central funding so that situation does not arise again.

This was a collaborative study designed by the audit steering group of the British Association of Otorhinolaryngologists Head and Neck Surgeons with the staff of the Clinical Effectiveness Unit at the Royal College of Surgeons of England. The methods used to collect and analyse data in this audit would be applicable to other surgical audits. We are indebted to the Clinical Effectiveness Unit for their advice on the design of the audit and for the statistical analysis and interpretation of the data. We are also grateful to all the clinical staff who have contributed to this study.

Mr John Topham
Chairman, Steering Group for the National Comparative Audit of Sino-Nasal Surgery

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Summary

- The National Comparative Audit of Surgery for Nasal Polyposis and Chronic Rhinosinusitis involved 80 NHS Trusts covering 87 NHS hospitals in England and Wales during a six-month period in 2000. The audit covers the work of 298 ENT Consultants and a total of 538 ENT surgeons.
- Patients undergoing surgery for nasal polyposis or rhinosinusitis were prospectively enrolled and have been followed up at 3 and 12-months post-operatively. A patient-centred outcome instrument, the SNOT-22, was used as the main outcome measure.
- 3,128 patients participated in the audit, of whom two-thirds had polyps present and one-third underwent only sinus surgery.
- Polyp extent is closely related to Lund Mackay score. The SNOT-22 score is not closely related to either Lund-Mackay score or polyp extent.
- Nearly one-third of patients undergoing sinus surgery had Lund Mackay scores ≤ 4, lower than the normal population.
- 3.9% of patients underwent surgery in the virtual absence of symptoms.
- Females report higher pre-operative SNOT-22 score, despite less extensive disease on cross-sectional imaging.
- Only 15.5% of procedures were performed as day-case surgery. This is significantly related to the use of packs post-operatively.
- Sino-nasal surgery is generally safe. The CSF leak rate was 0.064% and the periorbital haematoma rate was 0.2% with no long-term visual problems.
- Overall there is a high level of satisfaction with sino-nasal surgery.
- There is a clinically significant improvement in SNOT-22 scores for the sample as a whole at 3 and 12-months. There is deterioration in SNOT-22 scores from 3 to 12-months, with overall improvement remaining only just significant at 12-months in non-polyp patients
- Only 43.4% of sinus-only patients reported their symptoms as much better at 12-months, while 31.9% felt their symptoms to be the same or worse than before surgery
- Asthmatics and patients with a history of previous surgery tend to derive less benefit from sino-nasal surgery in terms of symptom improvement.
- All polyp patients benefit more from surgery than sinus-only patients, with benefit increasing as polyp extent increases. Greatest benefit is seen in patients with bilateral total obstruction.
- The pre-operative symptom score is the best predictor of outcome measured in terms of the SNOT-22. Patients with the highest SNOT-22 score preoperatively will derive the greatest benefit in terms of absolute and percentage change in SNOT-22 score.
- The distal extent of surgery being performed is significantly correlated to the extent of disease on cross-sectional imaging.
- 8.6% of patients had had or were awaiting revision surgery at 12-months.
- Almost all NHS Trusts and Consultants are performing within 95% confidence limits of the national mean SNOT-22 score at 3 and 12-months.

1. Introduction

1.1 Background to the audit

A consistent theme in recent policy statements by the National Health Service and the Department of Health in England has been the need for national comparative audit of clinical performance. The 1998 NHS Executive Consultation Document *A First Class Service - Quality in the new NHS* referred to "external audit programmes in which all hospital doctors in the relevant specialty and sub-specialty will have to take part." (section 4.9). [1] The 1999 NHS Executive Health service circular *Clinical Governance: Quality in the new NHS* stated that NHS Trusts had responsibility for "Ensuring that all hospital doctors take part in national clinical audits and Confidential Enquiries" (p. 14). [2] Responsibility for national clinical audit has passed to the Commission for Health Improvement which, according to the 2002 guidance from the Department of Health will "from 2002/03 start to endorse, develop and commission national clinical audits" (p. 3). [3]

As a response to the initiatives begun in 1998, and in recognition of the likelihood that a centrally planned and funded audit programme was unlikely to begin for some time, the Clinical Effectiveness Unit (CEU) at the Royal College of Surgeons of England initiated discussions on national clinical audit with the surgical specialty associations. The CEU endeavoured to identify one or more important and common surgical procedures to audit within each surgical specialty, together with appropriate measures of outcome and case-mix. This process continues and has advanced to a variable degree within different specialties. Considerable progress has been made with the Comparative Audit Group of the British Association for Otorhinolaryngology – Head and Neck Surgery (BAO-HNS) and a national audit of surgery for nasal polyposis and rhinosinusitis was carried out over the period 2000 to 2002. The audit was carried out in England and Wales, the countries covered by the Comparative Audit Group of the BAO-HNS.

1.2 Nasal polyposis

Nasal polyps appear to be outgrowths of the nasal mucosa, symptomatic of a chronic inflammatory disease known as nasal polyposis. They are located on the lateral wall of the nose, usually in the middle meatus or along the middle and superior turbinates. Most nasal polyps arise within the clefts of the middle meatus, with a significant proportion also arising from the ethmoid sinus. Polyps can also arise in the maxillary, frontal and sphenoid sinuses. The pathogenesis of nasal polyps is unclear. Nasal polyposis is not a single disease entity, but instead is a multifactorial disease often associated with asthma, and other respiratory diseases like cystic fibrosis, primary ciliary dyskinesia, and aspirin sensitivity. Genetic and infectious causes have also been suggested. A recent meta-analysis estimated that 7 to 15% of patients with asthma have nasal polyps.[4]

Nasal polyposis is a very common disorder. The overall estimated incidence of symptomatic nasal polyps was 0.63 patients per thousand per year in a recent Danish study.[5] Simple extrapolation using 2001 census data would imply almost 33,000 new cases of symptomatic nasal polyposis in England and Wales each year.

The management of nasal polyps may involve medical and surgical approaches. A variety of intranasal corticosteroids are effective in managing nasal polyp size. In the case of marked mechanical obstruction of the airways, or infection of the sinuses, surgical intervention is usually the treatment of choice.

1.3 The National Audit of Sino-Nasal Surgery

When choosing indicator procedures for national clinical audit, the CEU and the Comparative Audit Group of the BAO-HNS used the following criteria:

- Frequent in national terms
- Performed by most ENT Departments and at least 50% of ENT Consultant surgeons
- Severe in terms of impact on patient quality of life
- Reliable and valid outcome measures available
- Important outcomes measurable within 12-months

Surgery for nasal polyposis was deemed the most suitable candidate for audit using these criteria. The surgical treatment of nasal polyposis may involve simple removal of the polyps from the nose, but frequently involves surgery to the paranasal sinuses. The surgical treatment of sinusitis also sometimes includes the removal of nasal polyps. This overlap between the conditions and their treatment means that it is only possible to undertake a comprehensive audit of nasal polyp surgery by also covering surgery for rhinosinusitis. Thus the audit topic chosen was all surgery for nasal polyposis and/or chronic rhinosinusitis. Given the high incidence of nasal polyposis and the key role played by surgery, it is unsurprising that nasal polypectomies are very common. In the period April 2001 to March 2002, for example, Hospital Episode Statistics data (HES) indicate that around 9,000 nasal polypectomies were performed in NHS hospitals in England and Wales: a further 4,000 NHS sinus procedures which may have involved excision of nasal polyps were carried out over this period (see section 2.10 for more detail). In addition, surgery for nasal polyposis is carried out by all ENT Departments in England and Wales and most ENT surgeons within those Departments.

Nasal polyposis is a severe disorder to the extent that it is a chronic recurrent disease which will often lead to life-long morbidity. Nasal polypectomies are associated with a high recurrence rate. In a recent prospective cohort study, 75% of patients undergoing simple snare polypectomies had recurrent nasal polyps after a median follow-up period of 8 years.[6] Nasal polypectomy is often termed 'quality of life' surgery, in that the aim is symptom relief rather than cure. Disease-specific measures of health-related quality of life for this patient population, applicable to the first 12-months after surgery, have been developed and validated (see Methods section). Longer term outcomes such as polyp recurrence and repeat surgery are equally important indicators of 'success' but require long-term follow-up. The audit was designed to allow for such follow-up.

An important source of variation in outcome is variation in clinical practice. The National Audit of Sino-Nasal Surgery provides the opportunity to address important effectiveness issues in this area. There is evidence of considerable variation in clinical practice and a recent review commissioned by the NHS Research and Development Health Technology Assessment programme notes the paucity of current evidence regarding alternative techniques for polyp removal.[7] The possibility of addressing these questions was a further factor in favour of an audit of sino-nasal surgery.

1.4 Objectives

The objective of this audit was to compare, on a confidential basis, the outcomes of all surgeons and surgical units in England and Wales carrying out surgery to relieve the symptoms associated with rhinosinusitis and nasal polyposis.

2. Methods

2.1 Management of the project

A steering group had overall responsibility for the design and management of the audit, and the dissemination of results. The steering group consisted of five members: Mr John Topham, Consultant ENT Surgeon; Dr Barnaby Reeves, Director of the Clinical Effectiveness Unit at the RCS; Professor Valerie Lund, Consultant ENT Surgeon; Mr Rob Slack, Consultant ENT Surgeon; Dr John Browne, Lecturer in Outcomes Assessment at the Clinical Effectiveness Unit, RCS. Dr Browne took overall responsibility for co-ordinating the audit. The audit was 'endorsed' and important development was carried out by the Comparative Audit Group of the BAO-HNS. The Chair of the steering group, Mr John Topham, was also the Chair of the BAO-HNS Comparative Audit Group. Data collection was managed at the CEU by Ms Lynn Copley and Ms Jackie Horrocks. Statistical analysis and interpretation was carried out at the CEU by Dr Browne and Miss Claire Hopkins.

2.2 Audit principles

The recent HTA review of sino-nasal surgery makes it clear that the evidence base is insufficient to allow for 'process' audit based on adherence to predetermined standards of clinical practice.[7] This necessitates audit based on clinical and patient-based outcomes such as survival, quality of life and adverse events. Obtaining valid and meaningful estimates of the performance of surgeons in audits of outcome is complex and requires the following:

- high quality data collection, with measures of case ascertainment and data validity;
- relevant and valid measures of outcome;
- appropriate and valid measures of case-mix;
- appropriate and valid measures of clinical practice;
- a defined and representative sample;
- sufficient sample size to detect statistically and clinically significant variations in outcome;
- appropriate statistical analysis.

If any of these requirements are missing, the performance estimates for surgeons are likely to be invalid, misleading or ambiguous. In the context of national comparative audit, the consequences of invalid estimates could include:

- unfairly placing the reputations of individual surgeons or Trusts in jeopardy, in turn misleading the public and health care commissioners;
- reluctance among surgeons to operate on high risk cases, potentially making it difficult to recruit surgeons to 'high risk' specialties/subspecialties;
- a lack of co-operation with the collection of data.

2.3 Audit design

Given that the main objective of sino-nasal surgery is symptom alleviation, the main outcome measure used in this audit was a patient-based health related quality of life measure (see section 2.9). Power calculations (and by extension the time periods for data collection) for studies with continuous health-related quality of life outcomes are

difficult given that the definition of clinically important difference is to some extent arbitrary. By convention 'large' differences are defined as 0.8 standard deviations.[8] This conservative difference level was chosen by the steering group because of the uncertainty regarding the interpretation of differences in the patient-based outcome measure chosen, and the perception that 'large' and obviously important differences in outcome scores should be used to highlight concerns about the performance of health care providers.

Based on the literature, the standard deviation of the outcome measure used in this study is around 20 points.[9] The audit was designed to allow for the detection of a 16 point difference in outcome scores (i.e. 0.8 standard deviations) at a Trust level from a specific benchmark (i.e. the national average), with 95% power at the 0.05 significance level. These criteria were chosen as they combined the desire to detect only clinically important variation in outcomes (hence the choice of 0.8 standard deviations), with the need to ensure that the study was very likely to detect such an eventuality (hence the choice of 95% power). It was estimated that around 100 hospitals would participate in the audit, and that as a consequence the ratio of sample size at the hospital level to sample size at the national level would be around 100. This design required around 21 patients from the 'average' Trust, and at least 2100 patients at the national level to power the study.

The official time period for this audit began on April 3rd 2000 and ended on October 2nd 2000. This was considered a period of 'high-yield' for sino-nasal surgery given that it did not overlap with Christmas and the New Year (a period often associated with the cancellation of elective surgery). HES data for a similar time period in previous years indicated that that the 'average' Trust would collect data on around 45 cases over this time period, thus it would seem as though the audit ran for around twice as long as necessary. However, it was recognised at the design stage that the collection of data on 100% of cases was unlikely at the Trust level (e.g. because of non-participation by some ENT Consultants) and that a proportion of patients would be lost to follow-up. It was also recognised that many smaller Trusts would collect data on less than 45 cases over the audit period. A six-month audit period was chosen to maximise the likelihood of properly powering the study, without overly burdening local data collection staff in ENT Departments.

2.4 Ethical approval

The steering group received ethical approval for the audit from the North Thames Multi-Centre Research Ethics Committee in December 1999. 'Fast-track' ethical approval was then sought and received from the Local Research Ethics Committees of all participating Trusts.

2.5 Health care provider participation

HES data indicated that 156 NHS Trusts in England and Wales carried out sino-nasal surgery in 1998. All were invited to take part in the audit. Letters were written to Chief Executives in August 1999 inviting them to participate in the audit on behalf of their Trust.

A large amount of work must be carried out by a co-ordinating centre (i.e. the CEU) if national clinical audit is to meet the scientific criteria set out above. This work requires substantial funding. In the absence of central funding from the Department of Health or other government agencies, the CEU proposed that the cost of centralised tasks were covered by contributions from participating NHS Trusts. The overall budget for the audit was based on the cost of previous audits of a similar size carried out at the CEU.[10,11] To raise the financial support required, NHS Trusts were

asked to contribute a fixed amount to cover their participation. This amount reflected the likely volume of patients (based on HES data) that each Trust would include in the audit. Specifically, Trusts likely to have more than 50 patients included in the audit were asked to contribute £1,200. Trusts likely to have less than 50 patients included in the audit were asked to contribute £600. Fifty Trusts were identified as 'low' volume and 96 Trusts were identified as 'high' volume. A further 11 Trusts were not asked for a contribution for participation. These Trusts covered very low volume hospitals where sino-nasal surgery was performed on site, but carried out by visiting surgeons. The steering group felt that the attractiveness of the audit to these Trusts would be low, but that their participation and collaboration with data collection was important. It was agreed that these Trusts would not be charged for participation so that the likelihood of participation would be enhanced.

ENT Departments at Trusts willing to fund the audit were informed of this decision and invited to participate on a voluntary basis. Willing Departments were then asked to send a list of participating ENT Consultants, and contact names for data collection.

In 80 Trusts (51.3%), agreement was received at both the managerial and clinical levels, and data was collected. In 67 Trusts (42.9%) agreement was not forthcoming at the management level. In the remaining 9 Trusts (5.8%), agreement was received from Trust management, but the relevant ENT Department did not submit data.

The reasons put forward at the 67 Trusts where non-participation was a management decision were: finance not available (31 Trusts; 46.3%); clinical topic not a priority for clinical governance structures (29 Trusts; 43.3%); scientific misgivings about audit protocol (4 Trusts; 6.0%); clinician resistance to audit (3 Trusts; 4.4%). In the 9 ENT Departments where Trust funding was available, non-participation was due to logistic issues surrounding data collection.

It was agreed by the steering group that for the purposes of clinical audit, data should be analysed at Trust level as this is the ultimate level of responsibility in clinical governance terms. However 5 NHS Trusts performed sino-nasal surgery at more than one hospital. As a result there are 87 hospital sites covered by this audit. The audit covers the work of 298 ENT Consultant surgeons, 240 non-Consultant ENT surgeons and a total of 538 ENT surgeons.

2.6 Inclusion criteria

All patients listed for primary sinus surgery for chronic rhinosinusitis, or surgery for simple nasal polyposis, over the time period of the audit were targeted. Patients undergoing the following procedures (day-case and in-patient) were eligible for inclusion:

- Nasal polypectomy
- Maxillary sinus surgery
- Antrostomy (middle meatus and inferior meatus)
- Uncinectomy
- Ethmoid sinus surgery (bulla, anterior, posterior extents)
- Frontal sinus surgery
- Sphenoid sinus surgery
- Antral washout

The above list was sufficiently comprehensive to ensure that all patients undergoing nasal polyp excision were captured by the audit. It also provided valuable data on the surgical treatment of sinusitis. Patients undergoing the above operations were included even if (i) they underwent more than one of the above procedures at the same time (ii) they underwent other procedures (e.g. turbinate and septum surgery) at the same time. Additional procedures were recorded.

2.7 Exclusion criteria

Patients were excluded if the operation involved only septal surgery, sinoscopy, turbinate surgery, surgery for acute orbital cellulitis or surgery for mucocoeles. Patients under 16 years were excluded from the audit, as these patients present significantly different aetiology and treatment challenges to clinicians. Patients with significant learning disabilities and non-English speakers were not contacted for follow-up but non-identifiable clinical data was collected on their operations.

2.8 Patient consent

Patients were asked, during the peri-operative period, if they would be willing to complete a questionnaire about their symptoms prior to the operation, and to have questionnaires posted to them at 3 and 12-months post-op. It was made clear that they had the right to refuse to complete the questionnaires, and that involvement in the audit in no way impacted on their treatment.

2.9 Data collection

The following sequence of events in data collection was adhered to:

1. Patients were asked to complete a questionnaire about their current health status/symptoms and their previous treatments following pre-operative clerking. If the patient refused to complete the questionnaire, this was noted on the questionnaire by the staff member responsible for clerking, and returned with no patient identifiers on the form. Patients were asked at the end of the pre-operative questionnaire if they consented to have outcome questionnaires sent to them at 3 months and 12-months after their operation.

2. A small number of patients were only diagnosed in theatre: these patients were asked to complete the pre-operative questionnaire retrospectively at one month post-op, from memory (i.e. by describing what their symptoms were like before the operation). This retrospective questionnaire was sent directly to the patient's home address by the Trust, to avoid the release of patient named data without consent.

3. A clinical data proforma was completed by surgeons for each operation they carried out in the audit. This was completed even if patients had refused to complete a pre-operative questionnaire. The clinical data proformas and patient pre-op questionnaires were sent to the CEU, by the on-site hospital/audit staff co-ordinating the project.

4. Patients that had consented to follow-up were sent outcome questionnaires by the CEU to an address provided by the patient. The mailing contained a reply paid envelope addressed to the CEU. Names and

addresses for the outcome questionnaires were generated by running a weekly database search, and questionnaires were sent at 3 and 12-months after surgery. Reminder letters were sent to patients at 3 weeks and 5 weeks after sending the original questionnaire.

The proformas used were developed by the Comparative Audit Group of the BAO-HNS in conjunction with the CEU.

2.10 Patient participation

A surgeon-completed clinical data proforma was completed for a total of 3,128 patients. Of these, a pre-operative questionnaire was also completed by 2,852 patients (91.2%). 2,611 patients (91.5%) completed this questionnaire before their operation, and 241 patients (8.5%) completed the pre-operative questionnaire on a retrospective basis.

Of the 2,852 patients that completed a pre-operative questionnaire, 2,797 (98.1%) consented to follow up contact from the CEU. These patients were sent forms at both 3 and 12-months after their surgery. 2,336 patients (83.5%) responded at 3 months and 2,284 patients (81.7%) responded at 12-months. 251 of the 3-month responders did not respond at 12-months and 199 of the 12-month responders were 'new' (i.e. a 3-month form had not been received for these patients). The median point at which 3 month forms were completed was 15.6 weeks after surgery (range 13 to 65 weeks), with 90% of these forms completed by 6 months after surgery. The median point at which 12-month forms were completed was 53.0 weeks after surgery (range 48 to 100 weeks) with 95% of 12-month forms completed by 60 weeks after surgery.

2.11 Data collected

The main outcome measure for the audit was the total symptom score derived from a 22 item version of the Sino-Nasal Outcome Test (SNOT-22). The SNOT-20 is a previously validated patient based outcome measure applicable to sino-nasal conditions and surgery.[9] In addition to the normal 20-item version of the SNOT, two additional items were measured, nasal blockage, and sense of taste and smell. The Cronbach's alpha scores for the 22-item version were 0.91 at the pre-operative assessment, indicating high internal reliability, and providing assurance that the two new items measure aspects of the same underlying construct as the original 20 items. The theoretical range of the new measure is 0-110, with lower scores implying less severe symptoms. In patients where some SNOT-22 items were incomplete, a total score for the SNOT-22 was imputed from the mean of completed items, providing more than 50% of items had been completed. This is consistent with scoring practices for other patient-based outcome measures (e.g. SF-36).[12] A range of case-mix variables were collected in this audit, to allow for statistical risk adjustment, including the widely accepted Lund-Mackay computed tomography based staging system for sinus disease [13] and a widely accepted three point classification of polyp extent (I = confined to middle meatus; II = below level of middle turbinate but not causing total obstruction; III = causing total obstruction). Data on health care providers (e.g. Trust name, Consultant in charge) and treatment (e.g. use of endoscope) were also collected. Table 1 lists the variables collected in the course of the audit.

2.12 Case ascertainment

The objective of the case ascertainment exercise was to determine the percentage of eligible patients that were included in the audit for each Trust by identifying an independent source of data about operations performed over the audit period, and comparing this to the data received from the Trusts. The most common data source was a PAS

(Patient Administration System) printout covering the operations performed by the participating Consultants over the audit period. Theatre logs were examined in a few cases. Where a potentially eligible patient was identified from the PAS list but no matching clinical form was identified, a query was sent to the Trust asking that the case be reviewed, and that the CEU be informed whether the patient was in fact eligible but had been missed, or was ineligible (in which case the reason, and the type of surgery received was to be confirmed). The most common reason for excluding an eligible patient was non-participation by an individual Consultant surgeon within a Trust. The most common reasons for correct exclusion of a patient which appeared on the Trust PAS system were abandoned operations, and incorrect or ambiguous PAS coding (e.g. antrochoanal polyps).

The estimated total number of cases for a Trust was calculated as the actual number of cases received plus the number of extra cases queried as possibly missing, less the number of all these cases confirmed (or assumed) to be ineligible. The actual number of cases received was divided by the estimated total eligible cases to give a percentage case ascertainment.

The intensive case ascertainment tasks detailed above were only possible with 35 participating Trusts because of difficulties with PAS systems and other data collection issues. This process indicated that 77.0% of all eligible patients were captured in these Trusts (range = 34% to 100%).

To triangulate our in-depth estimates of case ascertainment HES data for the audit period 2000 to 2001 was examined. This data allowed us to ascertain the number of nasal polypectomies (OPCS code E08.1) performed within the data collection periods for each Trust. OPCS codes for non-polyp operations were too ambiguous to allow for case ascertainment. The number of polypectomies as recorded by HES was compared to the volume of polypectomies actually reported to the CEU. Data obtained using this method indicate that 67.0% of patients undergoing nasal polypectomies were captured in this audit (range = 11% to 100%).

Table 2 provides the case ascertainment estimates provided through both of the above methods for each participating Trust. It is clear that while overall case ascertainment was quite high, there was wide variation between Trusts. The true estimate of case ascertainment is likely to be around 70%. The Trusts that participated in the intensive case ascertainment are likely to be those that also had reliable case identification systems during the audit data collection period. If this is true, then the case ascertainment estimates for these 35 Trusts are likely to overestimate the overall levels (i.e. the true figure is lower than 77.0%). On the other hand, many of the patients identified by the larger HES dataset as 'missed' in the audit, may in fact be miscoded and ineligible. If this is true then the estimates produced by the HES data are likely to underestimate the overall levels (i.e. the true figure is higher than 67.0%).

2.13 Data validation

Data was validated by site visits. Requests for consent to medical notes review were sent to a sample of patients participating in the follow-up phase of the audit. Representative numbers of patients from each hospital were contacted. In addition, all patients experiencing an adverse event (as recorded on the clinical data proforma) were contacted for consent as this was considered to be a key item for validation.

The aim was to review case notes for 10% of patients (or a minimum of 10 patients) at each Trust. In total, this would imply the review of around 800 sets of patient medical notes. To meet these targets 1,605 patients were contacted and asked to consent to medical notes review, on the conservative assumption that 50% consent would be received.

1,318 patients (82.1%) consented to having their medical notes reviewed by a CEU data validator. 20 patients refused consent (1.2%) and the remaining 267 patients (16.7%) did not respond.

All patients that had been recorded as experiencing an adverse event, and that had also consented to medical notes review underwent medical notes reviews. Thereafter patients for notes review were selected randomly from the pool of those consenting, until 10% of patients (or a minimum of 10 patients) had been selected for each Trust.

Requests for case notes were made to hospitals in advance of the site visit. If the CEU was notified in advance that a set of case notes was going to be unavailable (e.g. would be required for clinic), then a substitute was identified at random. Where a set of notes was unavailable on the day the reason was noted.

Three CEU staff were trained in the validation process and all attended the first visit to gain familiarity with the layout of hospital case notes. A further 77 hospital visits then took place in 2001. The three validators visited 22, 25 and 30 hospitals respectively. Data validation visits to 9 hospital sites could not be organised due to logistic reasons at the sites concerned. In total, case notes for 729 patients were reviewed from the 78 hospitals. Each hospital in a multi-hospital Trust was visited separately if different Consultants were based at each. Visits were not arranged to four Trusts who had small numbers of consenting patients. For each set of case notes validated, the validator filled in a blank clinical pro-forma on the basis of the information recorded in the clinical notes. The breadth of clinical data collected in this audit made complete validation impractical. Ten key data items were validated. These questions were selected on the basis that the information would be readily obtainable from the case notes, and also that the items were highly important to the audit design. Table 3 shows the number of errors associated with each question.

The most frequent error occurred with respect to clinician rated comorbidities. For 169 (23.2%) patients information in the case notes indicated that a medical condition was present but this was not noted on the clinical pro-forma. This particularly applied to asthma. As a consequence of this it was decided that patient report of asthma would be considered the more valid data item.

The second most frequent error occurred with respect to adverse events. Data for 60 (8.2%) patients was found to be inconsistent. Either information on an adverse event was missing from the pro-forma but present in the case notes (15 patients) or was recorded on the pro-forma but could not be substantiated by notes review (45 patients).

For 45 (6.2%) patients an inconsistency was found with respect to ASA grade. This was generally a case of the grade being readily obtainable from the case notes but being marked as not known on the pro-forma, rather than a discrepancy with the value of the rating. Other common errors occurred with respect to previous medical treatments attempted. For 42 (5.8%) patients, the pro-forma indicated that no medical treatments had been tried but evidence of treatment was found in the case notes.

Data validity was considered to be generally good. Incorrect data was reported in less than 1% of cases, with most errors being omissions (e.g. asthma present but not recorded on clinical proforma). Errors were evenly distributed across hospital sites with no evidence of systematic erroneous data recording at any site. The source of most errors was incomplete data in either the medical notes or the clinical data proforma.

2.14 Analysis and feedback

A range of statistical analyses were carried out at the CEU using Intercooled Stata Version 7.0. Descriptive statistics on the patient case mix, and clinical practice were produced. Multivariate linear regression was used to develop a case-mix model. To take account of lack of independence within health care provider clusters (e.g. Consultant in charge of treatment), robust standard error estimates were used. Following this, risk-adjusted outcome data was produced for each Trust and Consultant surgeon. This was compared to the outcomes data for the national average as a whole to identify Trusts and surgeons performing outside the national confidence intervals. At all times during the analysis the confidentiality of individual patients, surgeons and Trusts was preserved with access to the named data allowed only to Dr John Browne and Ms Lynn Copley.

The results in this document are presented in a confidential coded format: individual Trusts and Consultant surgeons are not named. Although the audit was not powered to provide comparisons between surgeons, results are presented at the level of 'Consultant in charge of treatment' where a meaningful statistical analysis is possible. Participating Consultants will receive a code to allow them to identify the aggregate results of the patients under their care, providing they submitted a sufficient volume of cases to allow for statistical comparisons. This will allow them to compare their results to those of their peers and against the national average.

The Medical Directors of participating Trusts will also receive a code to allow them to identify the aggregate results of patients under the care of their Trust, providing the Trust submitted a sufficient volume of cases to allow for statistical comparisons. Again, they will then be able to compare the results of their Trust against those of other participating Trusts, and against the national average. It was agreed by the steering group that in cases where a Trust covered more than one hospital site, Consultants and Trusts Medical Directors would be interested in both the overall performance of the Trust and the performance of the constituent hospitals. Results are therefore presented at both the Trust and hospital level where relevant.

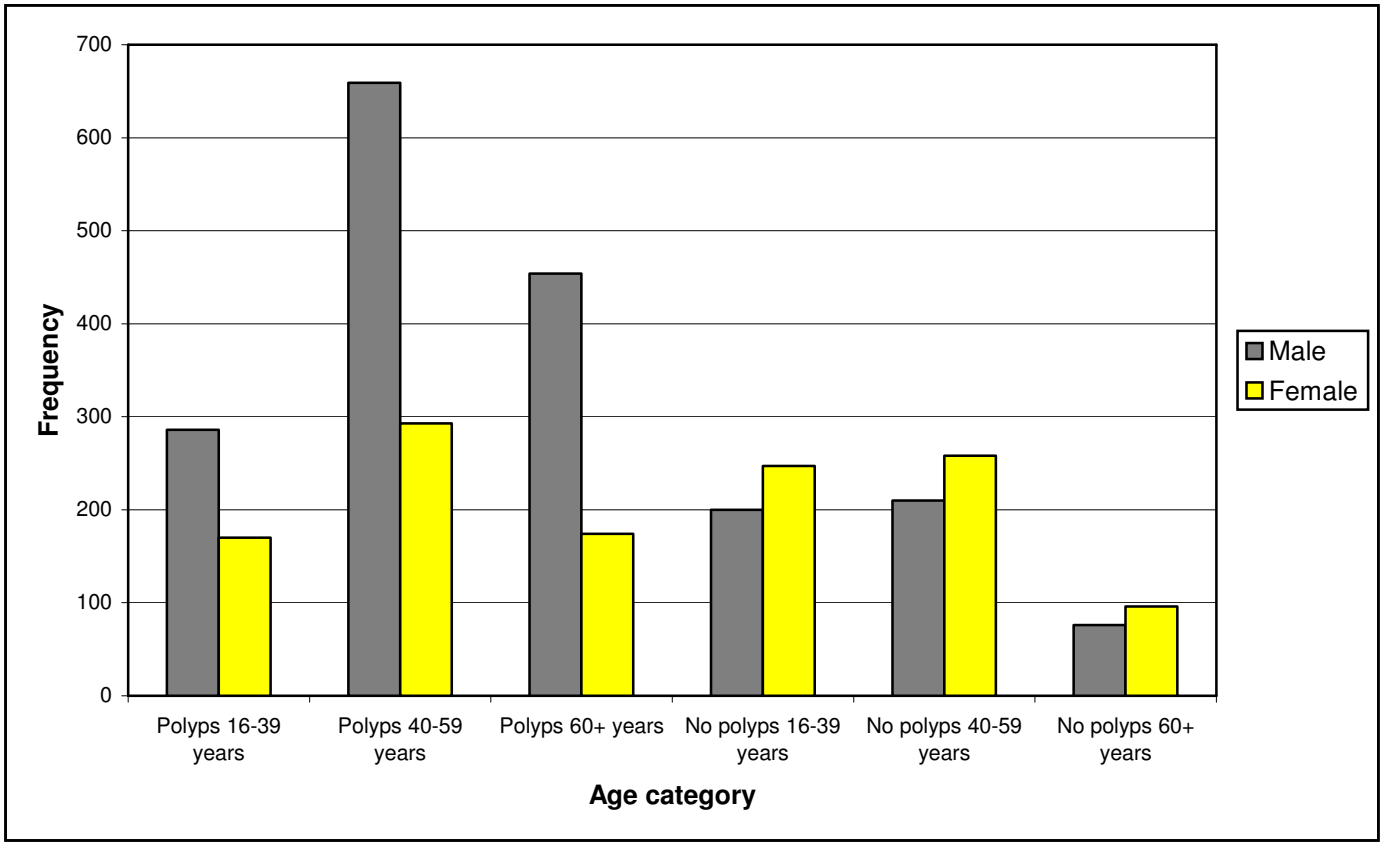
3. Description of patients

Data on 3,128 undergoing sino-nasal surgery was reported to the CEU in the course of this audit. 2,039 patients (65.2%) had polyps present and removed as part of surgery, either as a simple polypectomy or in addition to more extensive sinus surgery. The remaining 1,089 (34.8%) patients did not have polyps removed and underwent surgery to the sinuses only. These groups are separated throughout the analysis as these patient groups tend to have a different prognosis. Table 4 summarises the characteristics of the patients in this audit.

3.1 Age and gender

The mean age of all patients was 49.5, with a range of 16 to 94 years. The polyp group was almost 10 years older than the non-polyp group. 60.4% of all patients were male: this gender gap is wider for polyp operations where 68.7% of polyp operations were performed in men (Figure 1). This concurs with data previously published finding men outnumber women two to one in the occurrence of polyps. [14] In addition, HES data for the period 2000 to 2001 shows 68% of patients undergoing nasal polyp procedures to be male. Non-polyp operations were carried out in slightly more women (55%) than men.

Figure 1 Age and gender of patients



3.2 Duration of symptoms and previous treatment

The majority of patients had had their symptoms for more than five years (54.0%). However, in 234 (8.3%) patients undergoing surgery their symptoms had developed in the previous year.

As can be expected in a chronic and recurrent condition, 46.1% of all patients (52.0% of polyp patients, and 35.0% of non-polyp patients) had undergone previous surgery. The median time since previous surgery was six years, and this will be a key time point for future contact with this cohort. Asthmatics were more likely to have had previous surgery (58.0% versus 40.4% of non-asthmatics), as were males (48.0% versus 43.3% of women) and patients reporting allergies (50.3% versus 43.7% of patients without allergies).

According to clinician reported data only 85.3% of patients had been treated with steroids prior to undergoing surgery, despite recommendations of the Task Force on Rhinosinusitis that nasal steroid sprays are to be used in all patients before surgical intervention. [15]

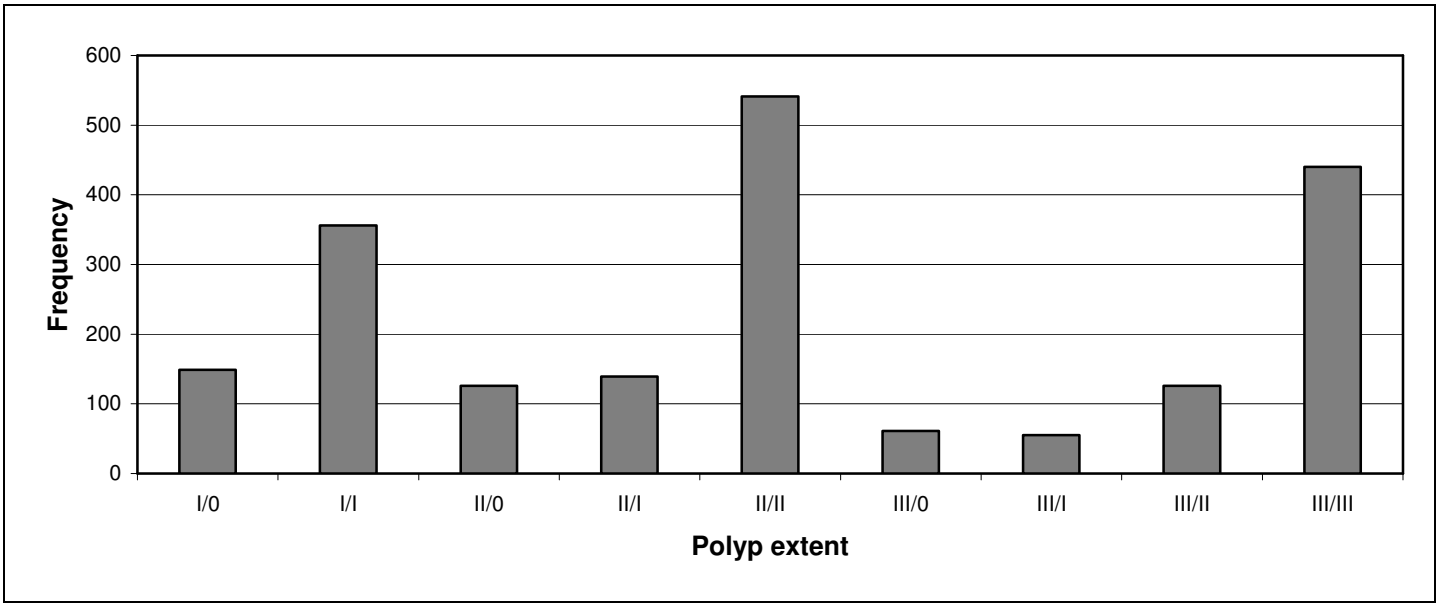
3.3 Comorbidities

The prevalence of physician-diagnosed asthma in the general population is 7%. [16] By comparison, 38.5% of polyp patients and 21.1% of non-polyp patients in this audit identified themselves as asthmatic. The association of nasal polyposis and asthma has long been recognized. The rate of aspirin sensitivity is also much higher in the polyp patients in this audit than in the general population (5.1% versus 1%).[17] Only 20.3% of all patients smoke, compared with the national adult smoking rate of 27%.[18] This may reflect the increased prevalence of asthmatics in the cohort, who are less likely to smoke. The majority of patients in the audit are generally healthy, with only 3.9% being classified as ASA grade 3 or above, and only 2.7% of patients rating their pre-operative general health as poor. 607 patients (21.2%) had purulent sinus infection at the time of surgery.

3.4 Extent of polyposis

Table 5 shows the extent of polyposis as recorded in 1993 of the patients undergoing polyp procedures, data being absent in a further 46. Polyps were graded by convention as grade I, confined to the middle meatus, II; extending below the level of the middle turbinate, and III; causing total obstruction. All combinations of asymmetry and sidedness are included. Bilateral symmetrical polyps are most common (Figure 2). Unilateral polyps account for 16.9% of the total.

Figure 2 Extent of polyposis in patients undergoing polypectomy

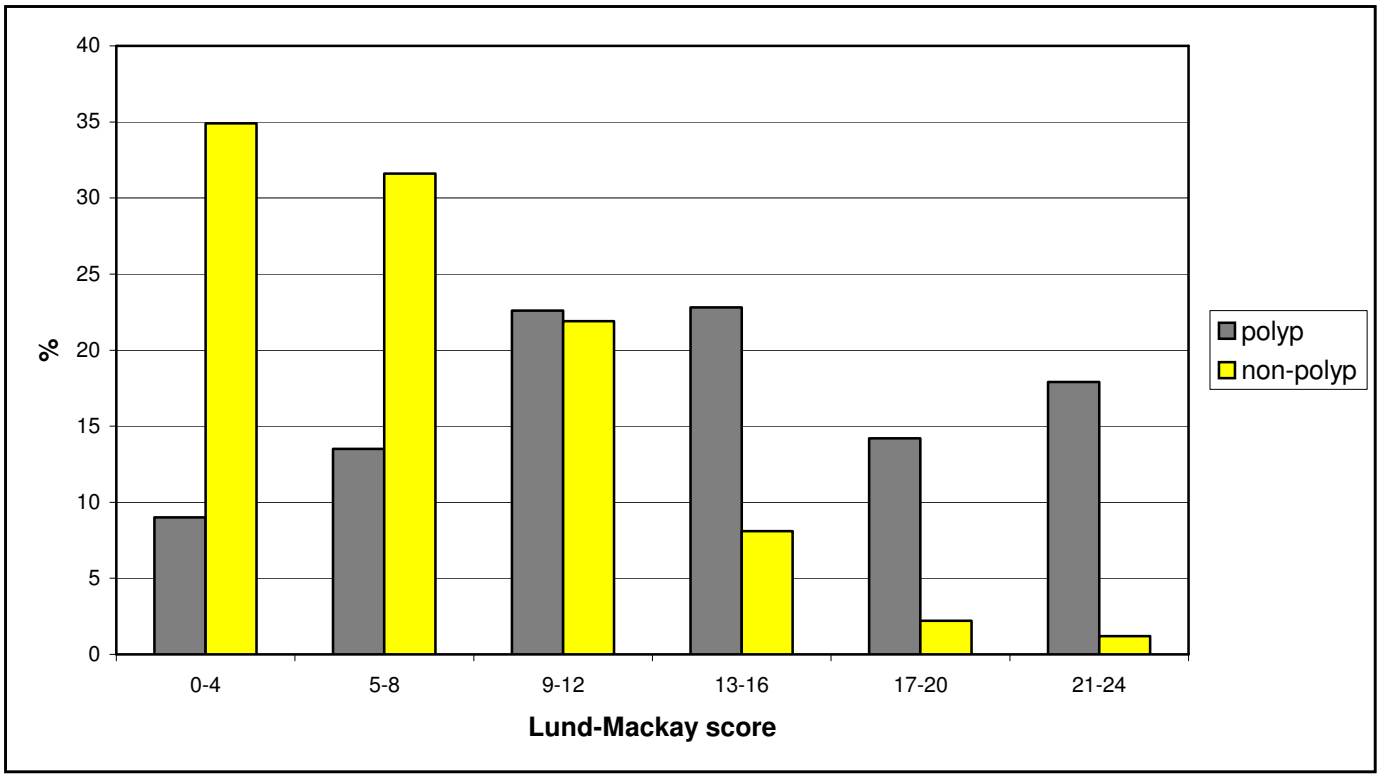


3.5 Lund-Mackay score

The Lund-Mackay scoring system, which is based on a simple numeric score derived from the CT scan, was used to stage the extent of inflammatory disease in the sinuses. [13] This is in keeping with recommendations of the Task Force on Rhinosinusitis that this system should be used for future outcomes research. [15] The total score is continuous and can vary between 0 and 24 points. Lund-Mackay scoring was completed in 58.8% of the total sample (N = 1,840), with an overall mean of 10.6 (95% CI = 10.3-10.9). Scores were available for 48.7% (N = 992) of patients undergoing polyp procedures and 77.9% (N = 848) of patients undergoing sinus procedures only. The lower CT rate in the polyp group is to be expected, given that cross-sectional imaging would not normally have been performed in the large number of polyp patients undergoing simple polypectomies. The Lund-Mackay scores were significantly higher in patients undergoing polyp procedures (mean = 13.6: 95% CI = 13.2-14.0) than those undergoing only sinus procedures (mean = 7.0: 95% CI = 6.7-7.3).

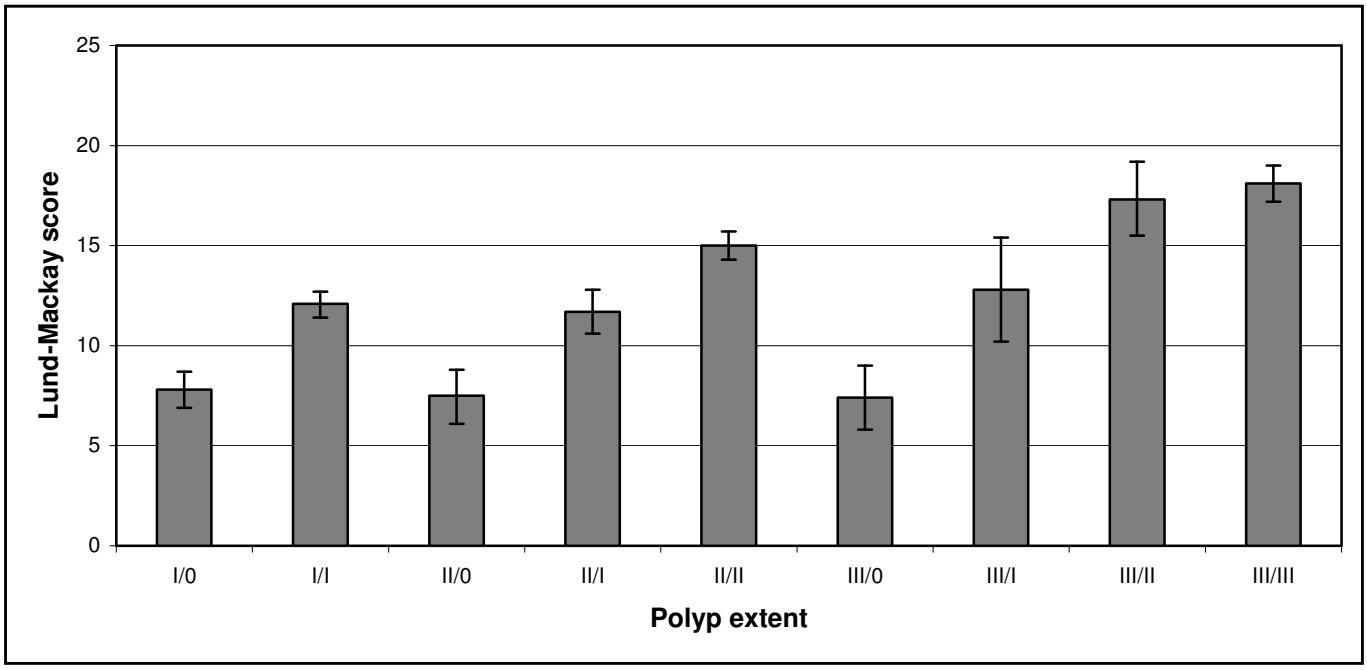
The distribution of the Lund-Mackay score among polyp and non-polyp patients is demonstrated in Figure 3. Nearly 300 patients (34.8%) underwent non-polyp sinus surgery in the absence of extensive disease on cross-sectional imaging (Lund-Mackay score ≤ 4). A recent study to determine the 'normal' Lund-Mackay score in patients undergoing imaging for non-rhinological symptoms found the mean score to be 4.3 (95% CI = 3.4-5.1). [19] Guidelines suggest Functional Endoscopic Sinus Surgery should be reserved for patients with a score greater than 4 (2 if unilateral) unless they are truly acute recurrent episodes. [20]

Figure 3 Frequency of Lund-Mackay scores for polyp and non-polyp patients



There is a clear relationship between extent of polyposis and Lund-Mackay score (Figure 4 and Table 6) with higher Lund-Mackay scores for patients with higher bilateral polyp grades. This relationship is not apparent among patients with unilateral obstruction.

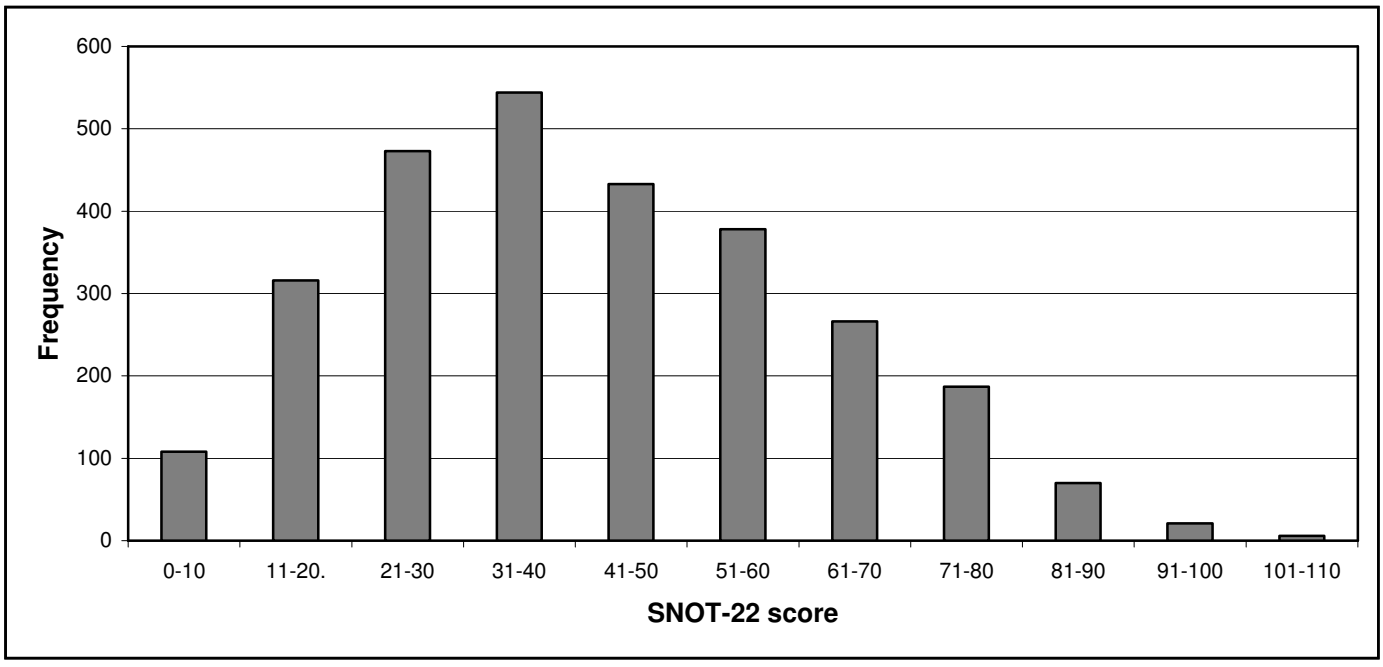
Figure 4 Lund-Mackay score by extent of polyposis in patients with polyps (95% confidence intervals shown)



3.6 Pre-operative SNOT-22 scores

Complete pre-operative SNOT-22 scores were available for 2,803 patients (98.3% of patients that completed pre-operative assessment forms, and 89.6% of all patients). The mean and 95% confidence intervals of these scores is available for each participating Trust (and for individual hospitals where a Trust had more than one participating hospital) in Table 7. The national distribution of pre-operative SNOT-22 scores is shown in Figure 5, and is a roughly symmetrical, bell shaped distribution. The mean pre-operative SNOT-22 score was 42.0 (95% CI = 41.2-42.7).

Figure 5 Pre-operative SNOT-22 score distribution



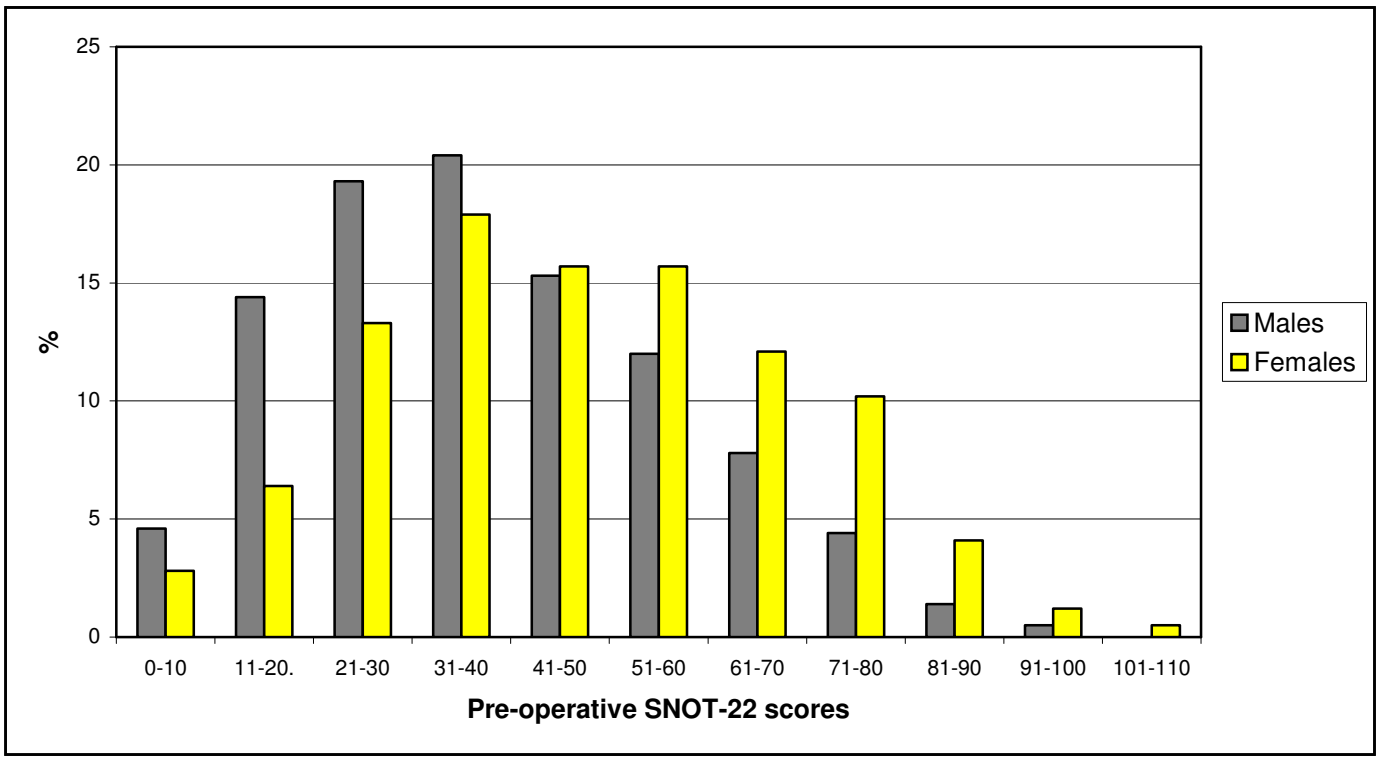
108 patients (3.9%) underwent surgery in the absence of significant symptoms at the time of surgery, with a SNOT-22 score of ≤ 10. Lund-Mackay scores were significantly lower in these patients (mean = 8.9: 95% CI = 7.4-10.3) than in those with higher symptoms (mean = 10.6: 95% CI = 10.3-10.9). This raises questions about patient selection if patients are submitted for surgery in the absence of significant symptoms.

The pre-operative SNOT-22 scores for key patient characteristics are shown in Table 8. Overall, there was a small but significant difference between the polyp and non-polyp patients, with pre-operative symptoms higher in the latter.

Older patients (aged 60 years or more) had lower pre-operative SNOT-22 scores in those patients undergoing polypectomies.

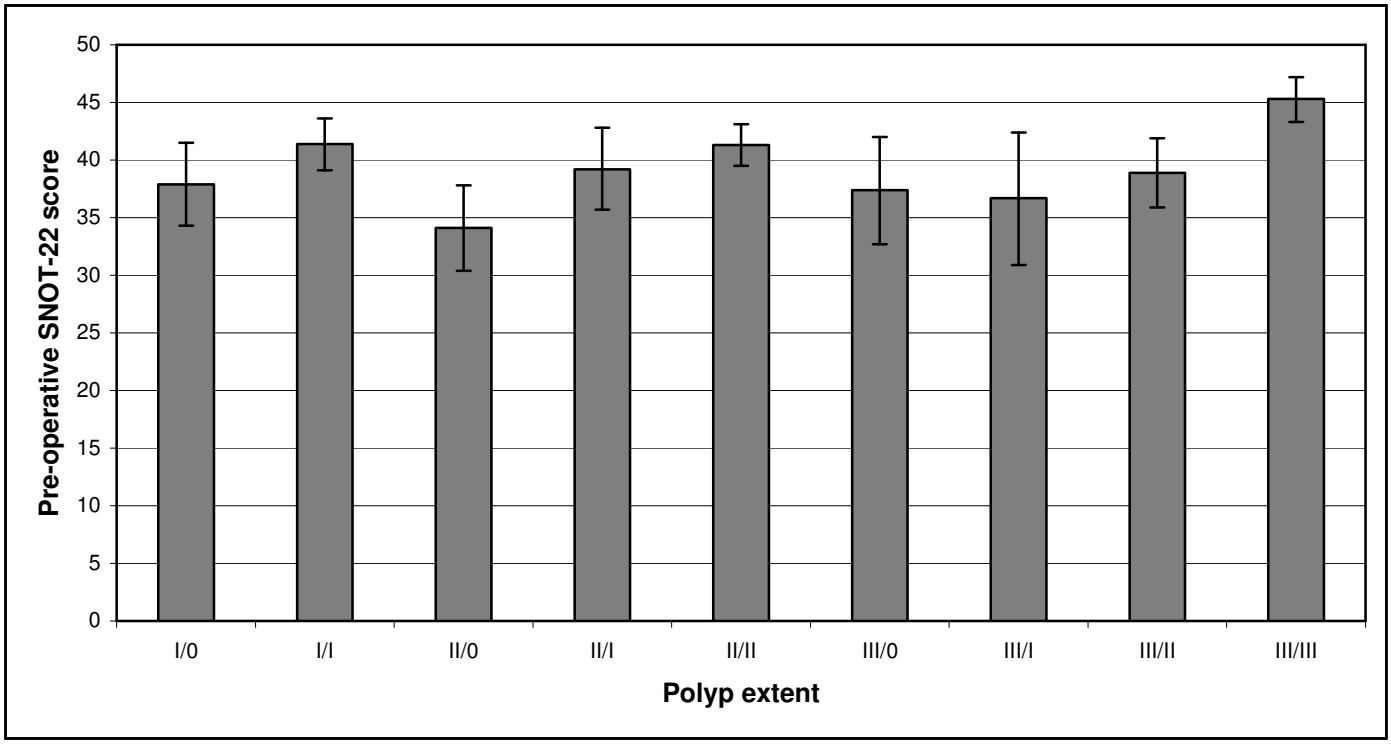
There is a clear gender difference with women reporting significantly higher pre-operative SNOT-22 scores for both polyp and non-polyp procedures (Figure 6). This gender difference is found in other quality of life assessment tools (e.g. SF-36) and may represent a systematic difference in response style rather than a reflection of underlying disease severity.[12] This is explored in more detail in Chapter Five.

Figure 6 Pre-operative SNOT-22 score separated by gender



There is a small increase in pre-operative SNOT-22 score with increasing extent of polyposis (see Figure 7). In addition, the SNOT-22 score is not significantly different for patients with a Lund-Mackay score ≤ 4 (mean = 41.8: 95% CI = 39.7-43.9) compared to those with a score of 15 or more points (mean = 45.5: 95% CI = 43.6-47.4). These findings suggest a complex relationship between patient perceived symptoms and clinician ratings of disease severity (see Table 8).

Figure 7 Pre-operative SNOT-22 score by extent of polyposis in patients undergoing polypectomies (95% confidence intervals shown)



Patients who had suffered their sino-nasal symptoms for longer periods, and patients who had had previous surgery reported significantly higher pre-operative SNOT-22 scores. Higher scores were also observed in smokers, asthma patients and patients reporting allergies, compared to patients without these risk factors (see Table 8).

3.7 Influence of dropout

The influence of dropout on the audit data was explored. Response rates from polyp and sinus-only patients were very similar at all time points. Clinical data was available for 3128 patients, 34.8% of whom had sinus-only operations. This compares to 34.4% of patients that completed a pre-operative questionnaire, 33.9% of patients that completed a 3-month questionnaire and 33.0% of patients that completed a 12-month questionnaire. The age profile of the sample was also very similar at all time points with a slightly higher response rate amongst those aged 60 years or more (25.5% of those for whom clinical data was available; 25.8% of those that provided a pre-operative questionnaire; 27.5% of those that completed a 3-month questionnaire; 28.8% of those that completed a 12-month questionnaire).

60.4% of the total denominator of 3128 patients were male. This compares to 60.3% of patients that completed a pre-operative questionnaire, 59.3% of patients that completed a 3-month questionnaire and 59.2% of patients that completed a 12-month questionnaire.

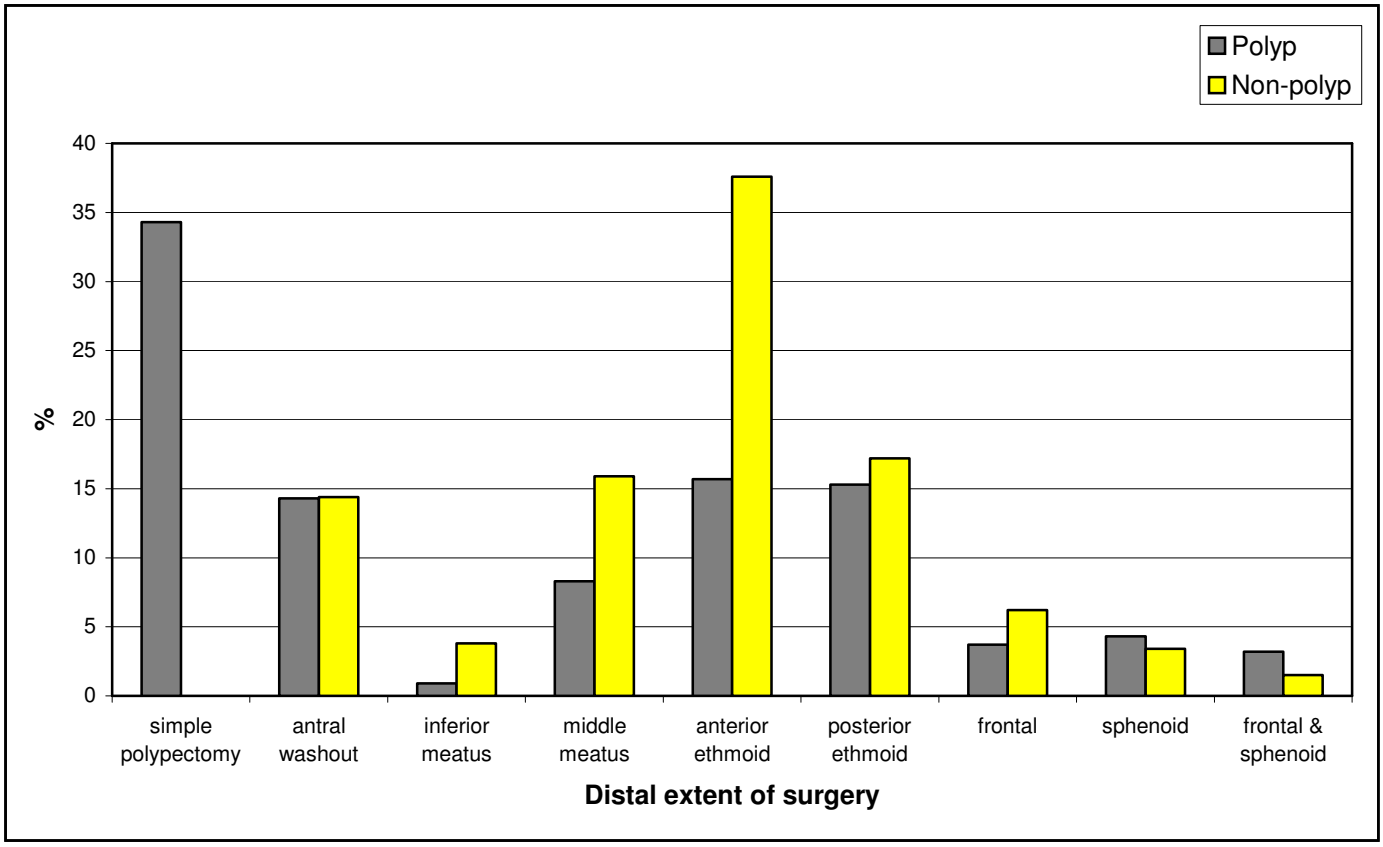
Patients that responded to the 3-month questionnaire had slightly higher pre-operative symptom SNOT-22 scores than those that did not. This difference was not present in the 12-month responders, indicating that pre-operative symptom status did not tend to influence a patient's decision to respond.

Patients that completed their pre-operative SNOT-22 assessment on a retrospective basis provided significantly worse estimates of their previous symptom status than those that completed the SNOT-22 before their surgery (Table 9). This discrepancy was controlled for in multivariate analysis of outcome (see Chapter Five).

4. Description of clinical practices

Table 10 shows the frequency of different operations in the audit. The format of the clinical data questionnaire generated more than 70 combinations of surgical procedures. In order to allow meaningful comparison, procedures have been grouped together as having the same distal extent of surgery, for example all procedures extending into but not beyond the anterior ethmoids. For purposes of brevity, the term 'middle meatus' refers to procedures that extended to the middle meatus and/or the uncinate process. The classification system groups together primary and revision procedures reaching the same distal limits and groups left and right side procedures together. The most common procedure described by distal extent in the presence of polyps is a simple polypectomy, and an anterior ethmoidectomy in the non-polyp group (Figure 8).

Figure 8 Frequency of operations by distal extent of surgery



4.2 Pre-operative imaging

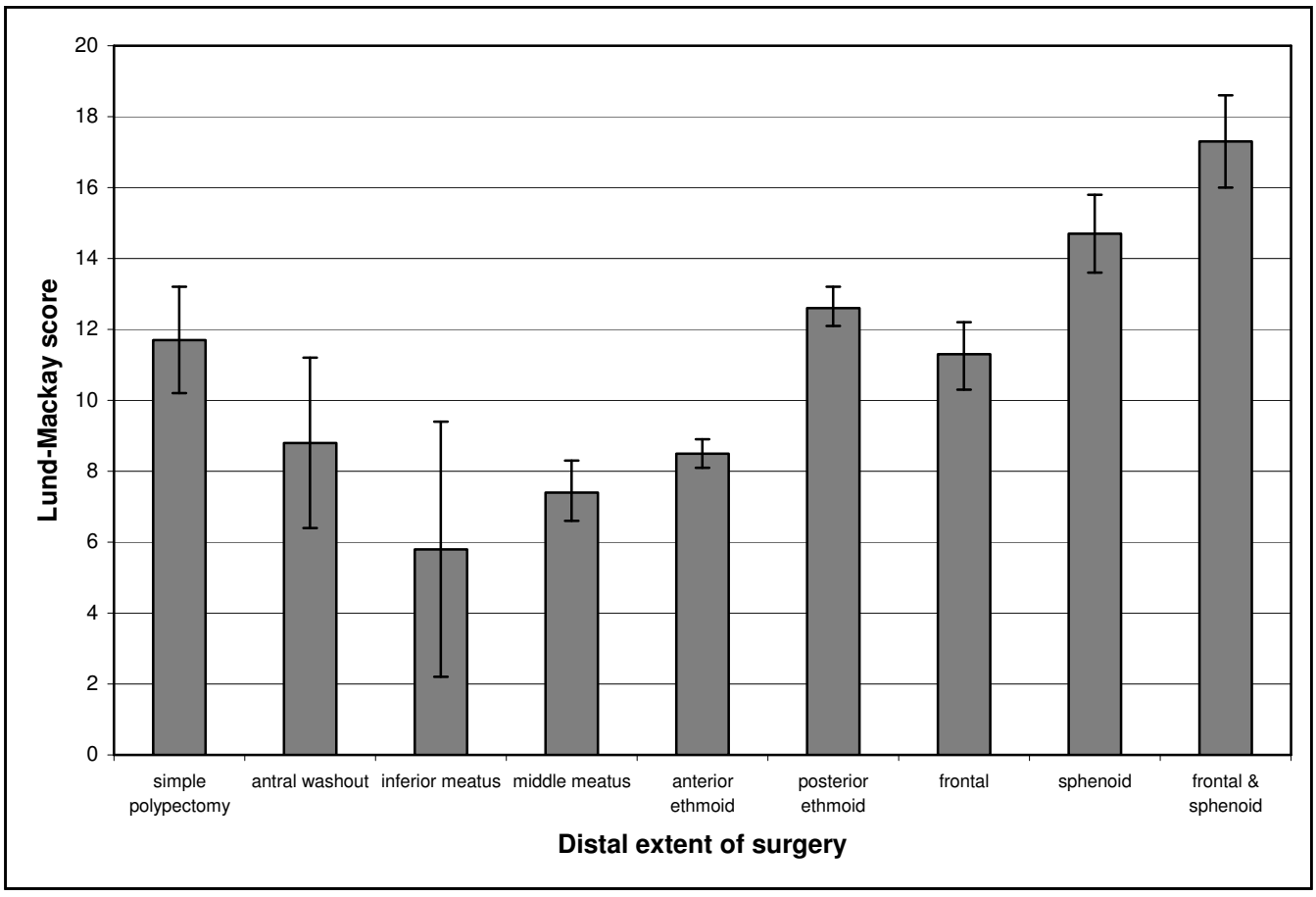
Table 11 shows the pre-operative imaging used. Cross-sectional imaging (CT and/or MRI) was performed in 50.8% of patients in the polyp group, 80.7% of the non-polyp group and 61.2% of all patients. In those patients who did not have such imaging, most underwent simple polypectomy, antral washout or middle meatal antrostomy (Table 12). However 27 patients underwent surgery extending into or beyond the posterior ethmoid sinuses in the absence of cross sectional imaging. 75 polyp patients (3.7%) underwent pre-operative x-rays, compared to 107 non-polyp patients (9.8%).

4.2 Extent of surgery

There is a tendency to perform less extensive surgery with increasing polyp extent. 16.5% of patients with bilateral grade I polyps underwent simple polypectomy, compared to 33.0% of bilateral grade II polyps and 41.6% of bilateral grade III polyps.

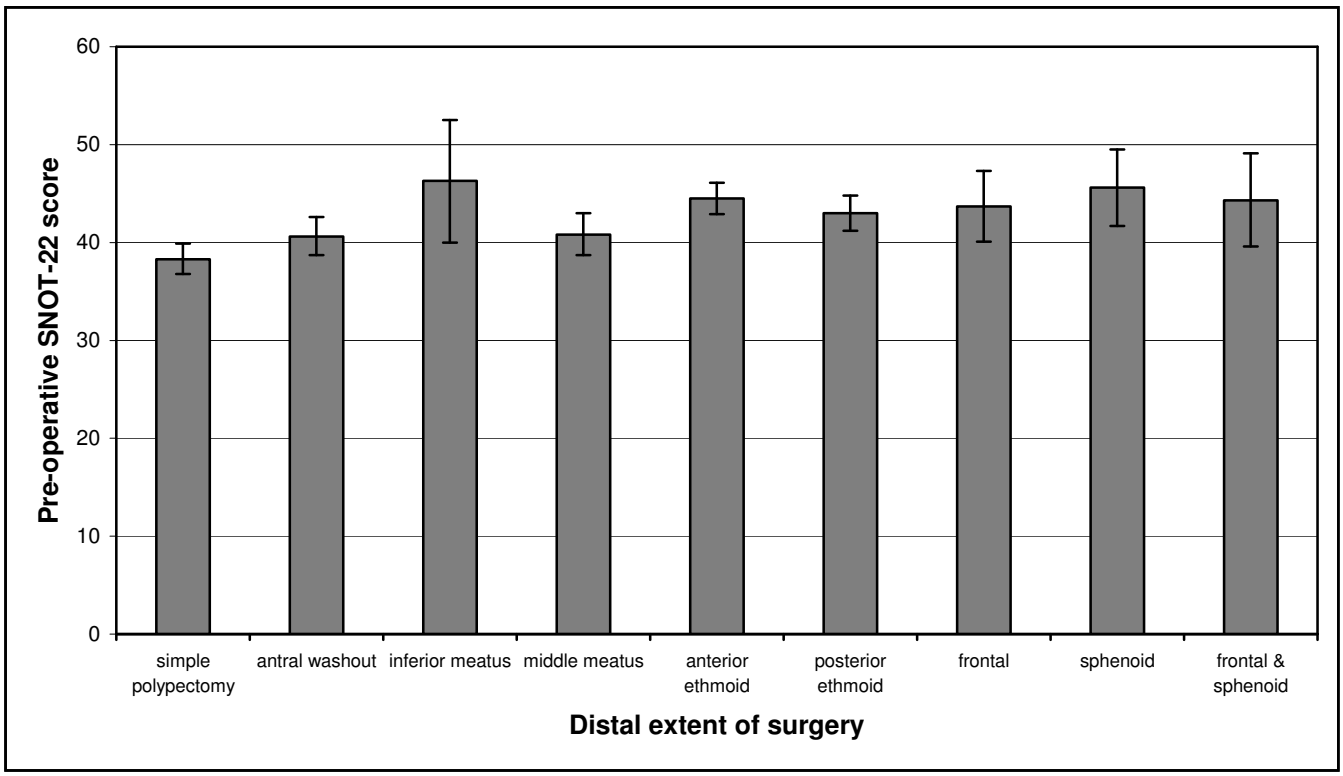
Comparing Lund-Mackay score where available with distal extent of surgery suggests the extent of sinus surgery is tailored to the severity of disease on cross-sectional imaging, in keeping with the Messerklinger technique (Table 13 and Figure 9). However, simple polypectomy patients, where such imaging is available, have a significantly higher Lund-Mackay score (mean = 11.7: 95% CI = 10.2-13.2) than patients submitted for anterior ethmoidectomy (mean = 8.5: 95% CI = 8.1-8.9) suggesting different indications are used when listing patients for a simple polypectomy than extent of disease on cross-sectional imaging.

Figure 9 Lund-Mackay score by distal extent of sinus surgery (95% confidence intervals shown)



The pre-operative SNOT-22 score does not seem to be a strong predictor of the distal extent of surgery (Table 14 and Figure 10), other than that patients undergoing simple polypectomy have significantly lower pre-operative SNOT-22 scores than those undergoing more extensive procedures.

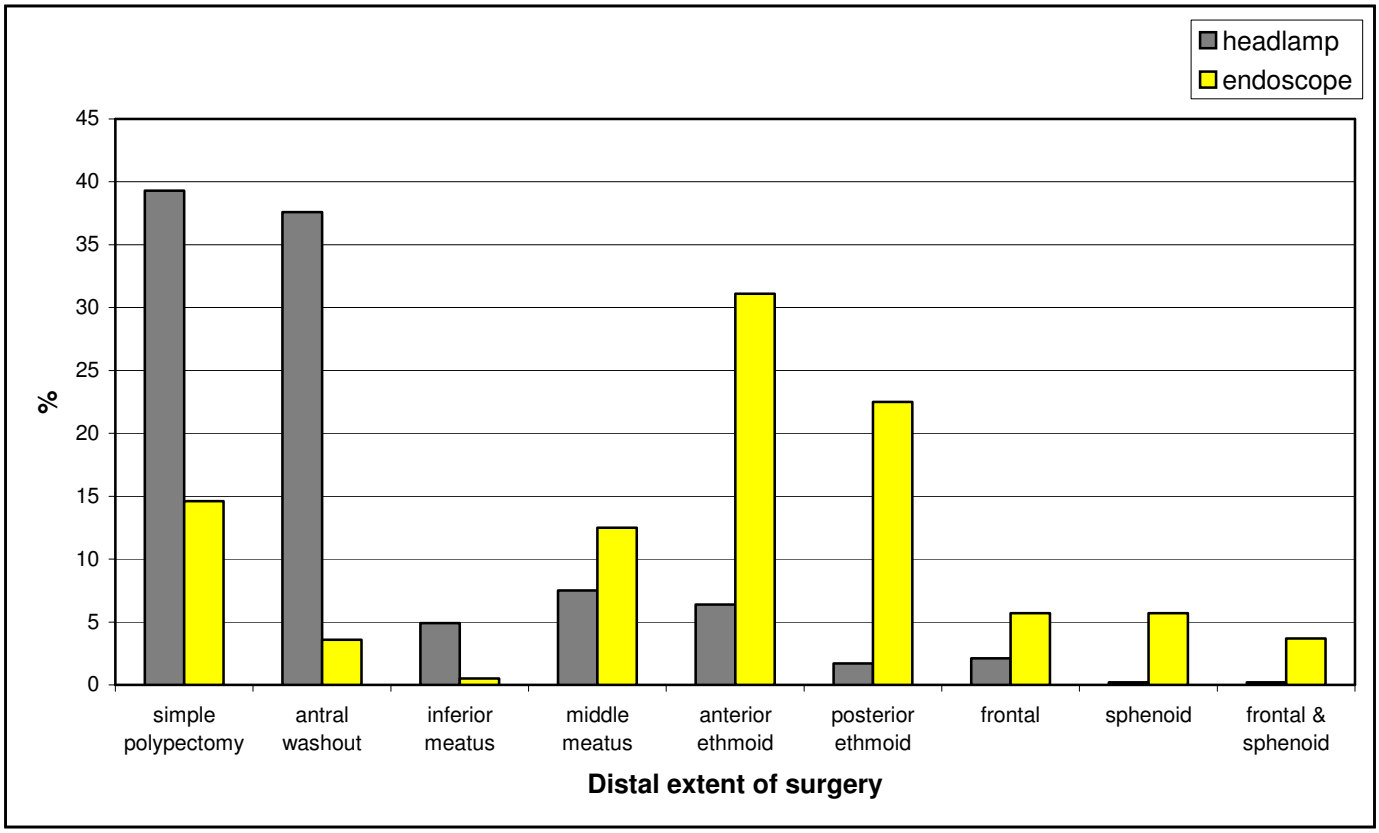
Figure 10 Pre-operative SNOT-22 score by distal extent of surgery (95% confidence intervals shown)



4.3 Illumination and removal techniques.

Overall 2145 procedures (68.6% of all procedures) were performed using an endoscope, the remainder using a headlamp (Table 15).

Figure 11 Illumination techniques by extent of surgery



The endoscope was more commonly used in procedures that did not involve polyp removal. 515 procedures (16.5%) used a debrider to remove excised material. The debrider was nearly always used in conjunction with an endoscope, but in 26 cases was used with only a headlamp to illuminate the surgical field. The headlamp was used most frequently for simple polypectomy or antral washout, and the endoscope more commonly in more extensive surgery (Table 16 and Figure 11) suggesting that endoscopic use is strongly linked to need for illumination.

Patients undergoing endoscopic procedures had significantly higher pre-operative SNOT-22 scores (Table 17). This difference was apparent only among patients undergoing polyp removal. The pre-operative SNOT-22 score did not vary significantly according to the instruments used to remove excised material.

Lund-Mackay scores were slightly higher in the endoscope group (mean = 10.7: 95% CI = 10.3-11.0) compared to the headlamp group (mean = 9.7: 95% CI = 8.4-11.0) but this failed to reach statistical significance.

There is a tendency to use the debrider with increasing polyp extent. 15.3% of patients with bilateral grade I polyps had the microdebrider used in their operation, compared to 24.9% of bilateral grade II polyps and 30.9% of bilateral grade III polyps.

4.4 Hospital stay and packing

Only 15.6% of all procedures were performed as day cases according to patient reported data. The mean length of stay for in-patients was 1.2 days with a median of 1 day. This is consistent with HES data showing the mean duration of stay for in-patients to be 1.2 days over the period of the audit (Table 18).

These figures compare poorly with the government target of 75% for all surgical admissions. A contributing factor may be the use of packing. Packs were used in 80.1% of overnight cases, and in 77.3% of these patients packs were only removed the following day. 55.5% of day-case procedures were not packed at the end of surgery, facilitating earlier discharge in these patients. However, the use of packing is also a function of operative severity, and day case patients tend to have less severe surgery. Patients managed as day-cases had significantly lower Lund-Mackay scores (mean = 9.0: 95% CI = 7.9-10.1) than those admitted overnight (mean 10.9 = 95%: CI = 10.5-11.2). Day case patients also had less extensive surgery: only 12.1% had surgery to the posterior ethmoid, frontal or sphenoid sinuses, compared to 30.6% of overnight patients.

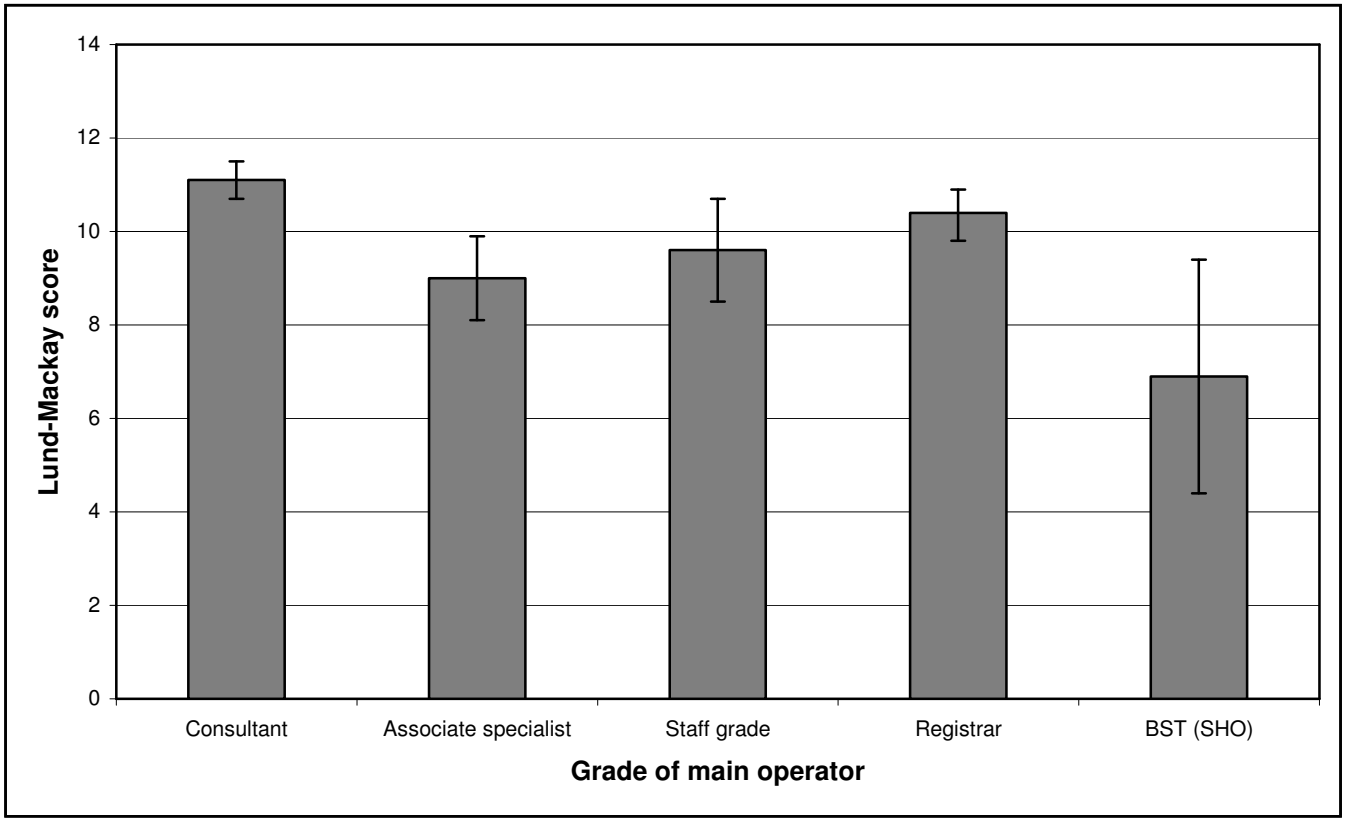
Mean pre-operative SNOT-22 scores are similar for day-case and in-patient cases (Table 19). The day case rates for individual Trusts (and for individual hospitals where a Trust had more than participating hospital) are shown in Table 20. Considerable variation in day case rates by health care provider is apparent.

4.5 Grade of surgeon

Consultant surgeons performed 45.8% of all operations. A Consultant was present in theatre for 65.9% of all procedures, 62.6% of polyp operations and 72.0% of non-polyp operations (Table 21). There is no significant difference in pre-operative SNOT-22 scores for each grade of main operator (Table 22).

However, the distribution of Lund-Mackay scores shows that Consultants tend to operate on those with the most extensive disease on cross-sectional imaging (Table 23 and Figure 12). Previous surgery does not appear to influence grade of main operator: 43.6% of primary operations were performed by a Consultant compared to 46.7% of repeated procedures.

Figure 12 Lund-Mackay score by grade of main operator (95% confidence intervals shown)



4.6 Other perioperative variables

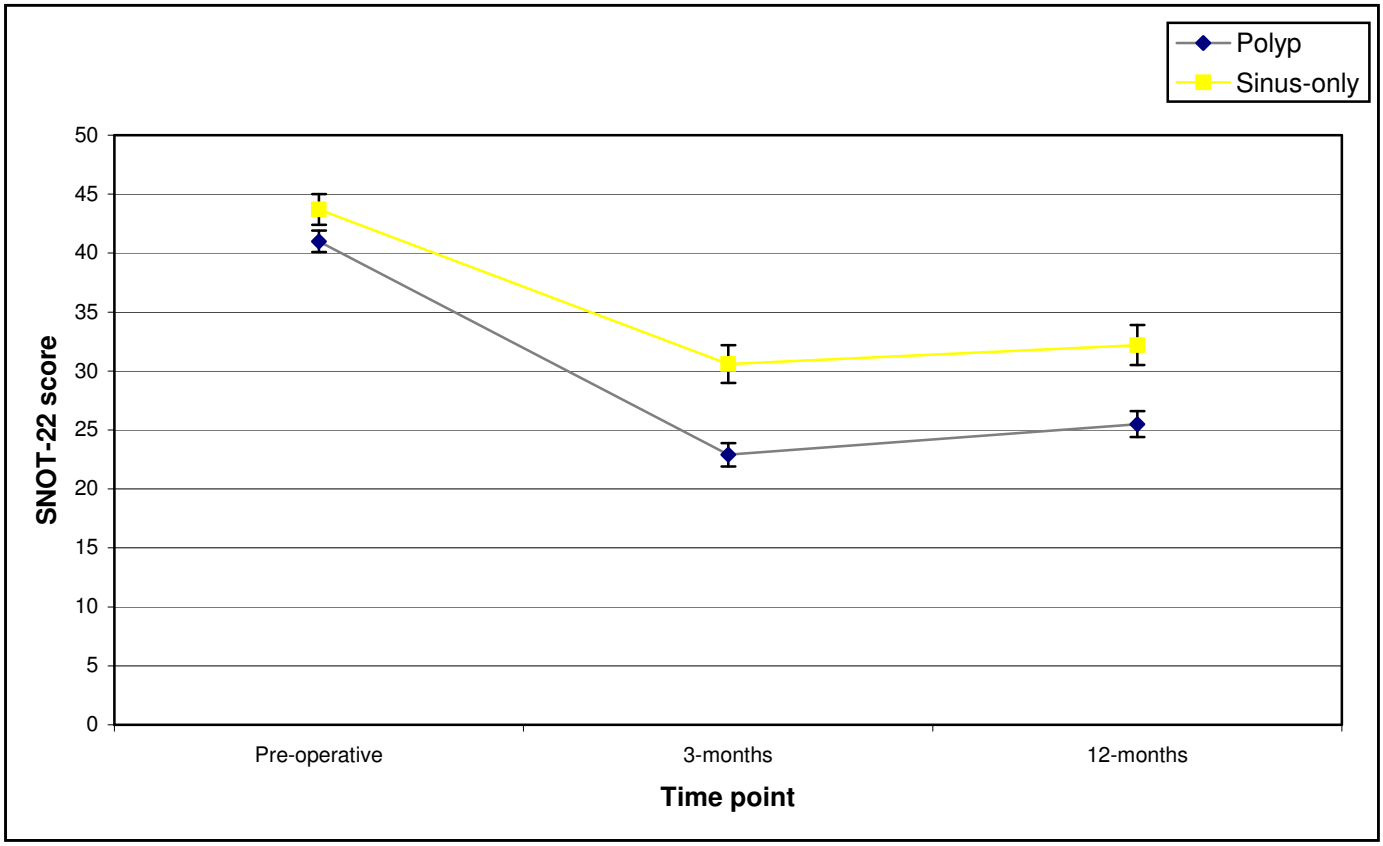
A summary of other important clinical practices is shown in Table 24. The mean surgical time ('knife to skin' to descrubbing) was 39.6 minutes, with procedures involving polyp removal taking slightly less time to perform. Most operations involved both a general and local anaesthetic (71.5%). Almost all operations (99.1%) used an intranasal approach, demonstrating the modern rarity of the Caldwell-Luc procedure. Diathermy was used in 6.7% of operations. Cocaine was the most common preparation used (65.1%).

5. Outcomes

5.1 SNOT-22 scores at 3 and 12-months

There is a statistically significant decrease in patient reported symptomatology as measured by the SNOT-22 from the pre-operative period to both 3 and 12-months for both polyp and non-polyp patients. Mean 12-month scores are significantly higher than 3-month scores among polyp patients and patients as a whole, indicating a worsening of symptoms from 3 to 12-months (Table 25 and Figure 13).

Figure 13 SNOT-22 scores at different time points in the audit (95% confidence intervals shown)

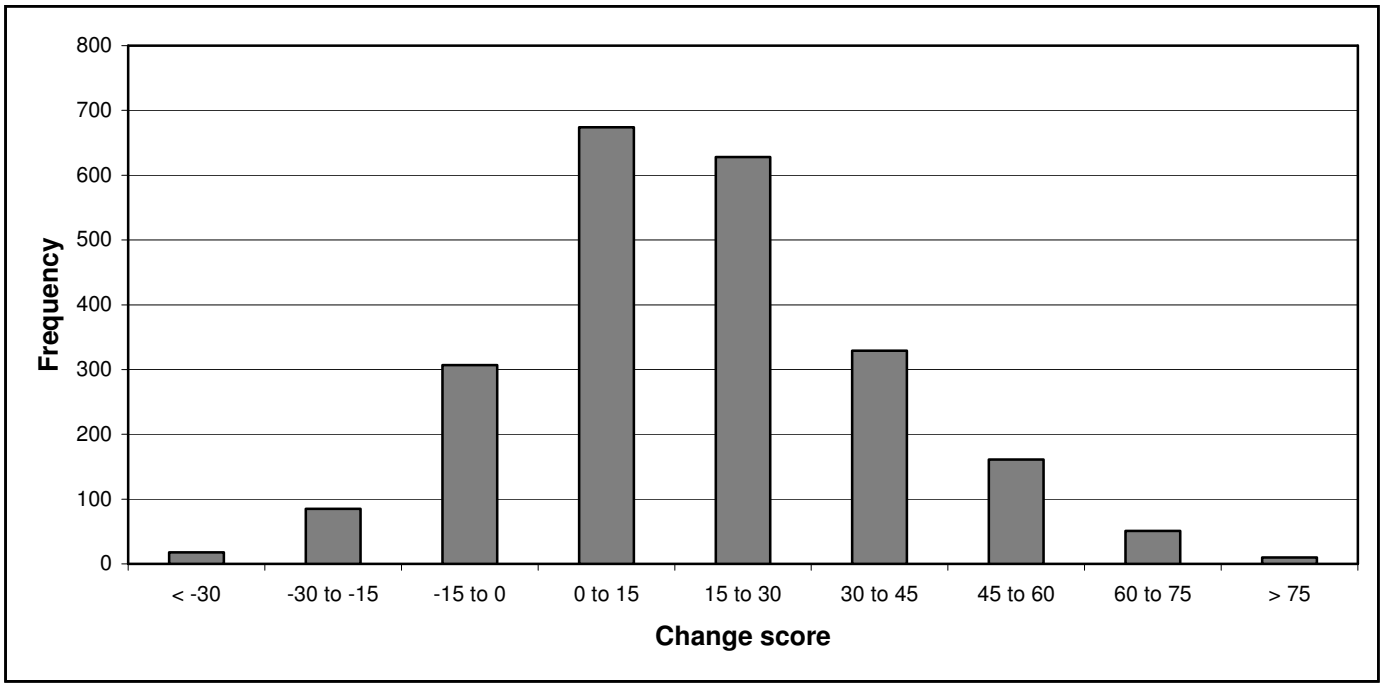


The effect sizes in this audit were calculated by dividing the mean change score at each post-operative time period by the baseline standard deviation for the relevant group. By convention an effect size of 0.2 is considered small, 0.5 medium and 0.8 or greater is considered large (27).[8] At 3-months the overall effect size was 0.81 with 0.9 for patients undergoing polyp procedures and 0.64 for patients undergoing only sinus operations. At 12-months the overall effect size was 0.7, with 0.81 for polyp patients and 0.56 for sinus-only patients.

Although the relative drop in mean SNOT-22 scores seems large (34% for all patients from pre-operative assessment to 12-months) the effect sizes are slightly less impressive. One of the reasons for this is the very large standard deviation in pre-operative SNOT-22 scores. Patients undergoing sino-nasal surgery have a heterogeneous symptom profile, with many patients reporting few or no symptoms before their surgery, and others reporting the worst possible situation. For example, 760 patients (26.6%) had a pre-operative SNOT-22 score of less than 27.7, which is less than the average score for the whole cohort at 12-months. In these patients, improvement is likely to be difficult to achieve and demonstrate.

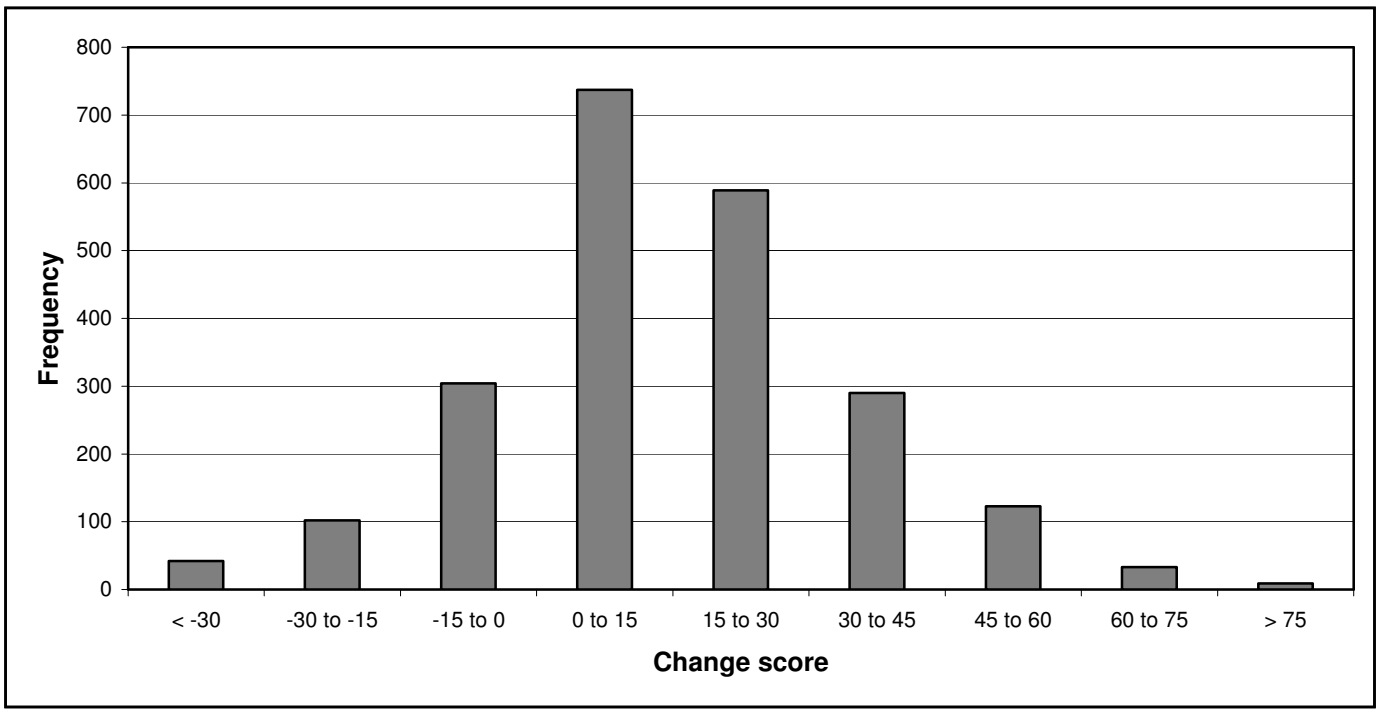
The distribution of change in SNOT-22 scores from pre-operative assessment to 3-months is shown in Figure 14. Change scores were available for 2263 patients and were calculated by subtracting the SNOT-22 score at 3-months from the preoperative SNOT-22 score. Higher change scores represent greater symptom improvement. The mean change score at 3-months was 17.0 (i.e. a mean drop of 17 points in the SNOT-22 score) with SD = 20.2 (range: -45 to +91).

Figure 14 Distribution of change in SNOT-22 scores from pre-operative assessment to 3-months



The distribution of change in SNOT-22 scores from pre-operative assessment to 12-months is shown in Figure 15.

Figure 15 Distribution of change in SNOT-22 scores from pre-operative assessment to 12-months



Change scores were available for 2229 patients and were calculated by subtracting the SNOT-22 score at 12-months from the preoperative SNOT-22 score. The mean change score at 12-months was 14.4 (i.e. a mean drop of 14.4 points in the SNOT-22 score) with SD = 20.2 (range: -57 to +89).

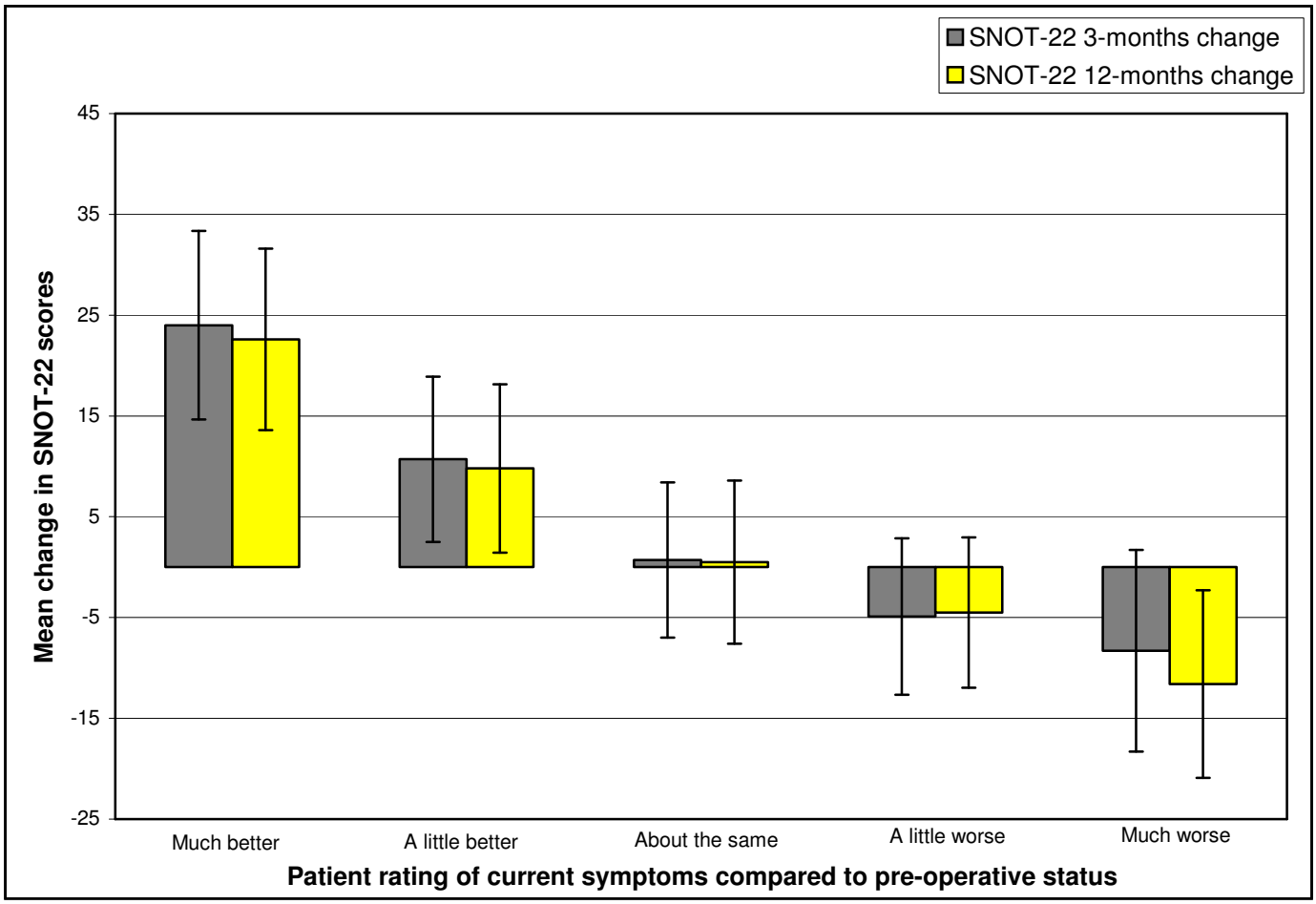
5.2 Return to normal lifestyle

97.5% of patients had returned to their normal work activities at 3-months after surgery. 96.8% of patients had returned to normal social activities and 95.4% of patients had returned to their normal leisure activities and hobbies. The median time to return to work, social and leisure activities was 2 weeks. 29.6% of patients reported returning to normal work activities 1 week after surgery and 44.9% after 2 weeks. 94.2% of patients had returned to their normal work activities within 4 weeks.

5.3 Patient satisfaction with their operation

Patients were asked how their symptoms at 3 and 12-months post-surgery compared with the preoperative situation. The same pattern emerges: patients undergoing polyp removal tend to perform better than those undergoing only sinus operations, and in both groups there is mild deterioration between 3 and 12-months. Overall, 62.3% of patients rated their symptoms as much better at 3-months. This fell to 56.7% of patients at 12-months (Table 26).

Figure 16 Mean SNOT-22 change scores at 3-month and 12-months by patient rating of symptom change from pre-operative status to 3-months and 12-months (one standard deviation around the mean shown)



Patients' assessment of how their post-operative symptoms compared to their pre-operative status was strongly related to the change in their SNOT-22 score (Figure 16). In a similar manner patients were asked at 3 and 12-months to rate the overall results of their operation. Again polyp patients were more likely to rate their surgery as excellent or very good, and the ratings deteriorate from 3 to 12-months (Table 27). At 12-months, 50.9% of all patients are willing to rate their operation as 'excellent' or 'very good'.

5.4 Patient satisfaction with information provision

50% of patients reported receiving both written and verbal information about their operation. A further 45% received only verbal information while 1.0% reported receiving no information at all. 83.5% of patients rated the information they received about their operation as good or excellent.

Only 7.2% of patients reported receiving both written and verbal information about their post-surgical treatment. 57.3% received only verbal information while 32.4% reported receiving no information at all. 58.4% of patients rated the information they received about their future treatment as good or excellent, while 17.8% rated it as poor.

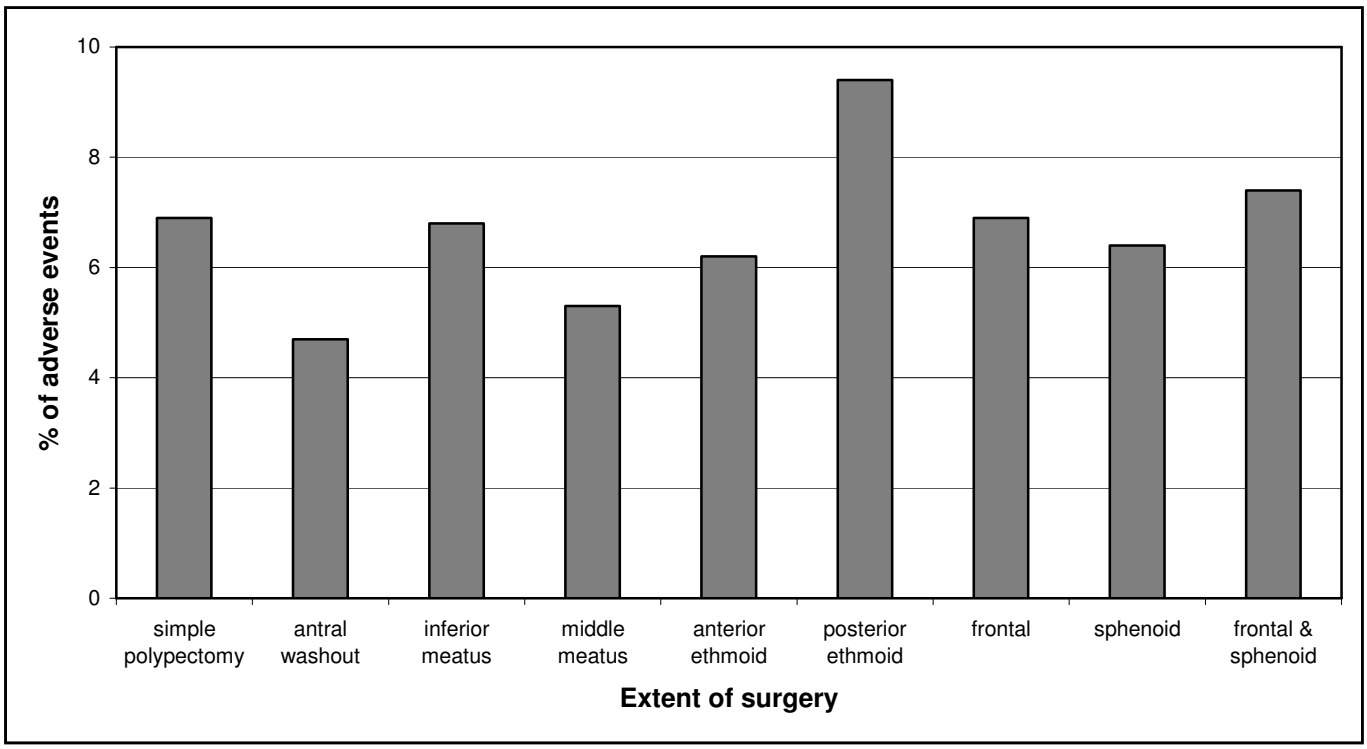
5.5 Pain

Most patients did not complain of significant pain during or after their operation. However, 3.3% of patients complained of severe pain during their operation, and a further 9% reported severe pain on the first day after the operation which may indicate isolated problems with anaesthesia and pain control. At least some of these pain control issues are related to the non-use of general anaesthetic. 40.8% of patients who had received only a local anaesthetic reported moderate or severe pain during their operation, compared to 13.8% of patients who had received a general anaesthetic and 12.8% of patients who had received both a local and a general anaesthetic. A substantial proportion of patients (61.7%) were still in some pain 1 week after their operation, but most of these report the pain as mild in nature (see Table 28).

5.6 Adverse events

There were no adverse events reported by clinicians in 93.4% of procedures. One adverse event was reported in 192 cases, two adverse events were reported in 14 cases and three adverse events were reported in one case giving a total of 223 adverse events. Adverse events were more common during polyp procedures (8.4%) compared to sinus-only operations (3.2%) due to a higher rate of perioperative bleeding during polyp operations. The most common adverse event reported was excessive bleeding during the operation (5.0%) followed by excessive bleeding after the operation (0.8%). There were seven reported orbital complications. Five cases were reported as peri-orbital haematoma, two as peri-orbital surgical emphysema, and there were no reported cases of reduced visual acuity. There were a further 13 reported cases where the lamina papyracea was breached, but this was identified during the course of surgery and no adverse event was noted. These have therefore not been counted as adverse events. Two intra-cranial complications occurred. These were both reported as small CSF leaks observed at the time of surgery and a patch repair was performed during the primary procedure. Clinician-reported adverse events do not appear to vary according to the extent of the surgical procedure (Figure 17).

Figure 17 Proportion of adverse events occurring in different operations as defined by surgical extent



41.4% of patients reported bleeding problems after discharge. Bleeding problems were more common among patients undergoing non-polyp procedures (49.2% versus 37.5% in patients undergoing polyp removal). 3.4% of patients sought hospital treatment for their post-discharge bleeding problems. 3.8% of all patients were readmitted to hospital for a sino-nasal problem within 3-months of their surgery. The distribution of adverse events by type of operation is shown in Table 29.

5.7 Contact with GP

31.9% of patients consulted their general practitioner for sino-nasal problems on one or more occasions (other than to renew a prescription) in the first three months after their surgery. 2.9% visited their doctor on more than 3 occasions during this period (Table 30). The proportion making a GP visit for sino-nasal problems in the 9-month period between 3 and 12-months after surgery was 34.3%, which represents a considerable fall in the rate of GP consultation given that the figure covers an extra six months. GP visits tend to be more common among patients that had undergone non-polyp operations.

5.8 Revision surgery rates

3.7% of patients had undergone revision surgery for their nasal or sinus symptoms within 12-months of the original procedure recorded in the audit. A further 5.0% of patients were on a waiting list for revision surgery when contacted 12 months after their original operation. The rate of revision surgery was higher in patients that had originally undergone non-polyp procedures (4.7% versus 3.3% of patients undergoing polyp procedures). By contrast, the rate of re-entry to the sino-nasal surgery waiting list was higher in patients that had originally undergone polyp procedures (5.6% versus 3.6% of patients that had undergone non-polyp procedures).

5.9 Post-operative medication

65.0% of patients reported that they had been prescribed steroid medication in some form in the 3-month post-operative period. Steroid medication prescription was higher among polyp patients (68.9% versus 57.3% of patients undergoing non-polyp procedures). 16.1% of all patients had been prescribed oral or injected steroid medication.

At 3-months 52.4% of patients reported that they were currently taking medicine for a sino-nasal problem. At 12-months this proportion was roughly the same (51.9%). However, the group of patients taking sino-nasal medication at 3 and 12-months was far from identical. Among patients where data was available for both time points, 25.7% took sino-nasal medication at 3-months but had discontinued at 12-months. 23.3% were not taking such medication at 3-months, but had begun to do so at 12-months.

At both time points sino-nasal medication use was roughly 10% higher in the group of patients that had undergone polyp procedures, compared to the non-polyp patients. Post-operative medications included topical and oral antihistamines, topical and oral corticosteroids, decongestants and antibiotics (see Table 31).

6. Risk-adjusted outcomes

Case-mix adjustment of patient outcomes was performed so that fair comparisons could be made between health care providers. Multivariate linear regression was performed to develop a case-mix model for the National Sino-Nasal Audit. The outcome variables used in the regressions were the 3 and 12-month SNOT-22 scores generated by patient outcome questionnaires. Twenty-four case-mix variables were used in the development of the case-mix model. Variables considered to be under the control of the health care provider (e.g. use of endoscope, grade of operating surgeon) were not entered into the model.

A conservative approach to selection of case-mix variables was used throughout. Regression analyses were performed with the aim of identifying all case-mix variables that were significantly associated with the post-operative SNOT-22 scores at a significance level of 0.2. For categorical variables with more than 2 categories, the overall variable was included if one of the within variable category comparisons produced a p-value less than 0.2. Separate regressions were performed on 3 and 12-month outcomes, but the goal was to develop a single case-mix model. It was agreed that case-mix variables had to satisfy statistical criteria in only one of the regressions in order to qualify for the final case-mix model.

The selection of variables involved the following steps:

1. Backward elimination of variables until all remaining variables had $p < 0.2$ within the model.
2. Re-entry of eliminated variables into the final model produced by step 1. These variables were re-entered individually, in the order in which they had originally been eliminated to ensure that the p-value for the variable remained above 0.2.
3. Consolidation of the 3 and 12-month models so that all important variables are included in a unified model.

To take account of lack of independence within health care provider clusters (e.g. Consultant in charge of treatment), robust standard error estimates were used. It was agreed that the most relevant cluster unit for this analysis was the Consultant in charge of treatment. This method produced an 18 variable case-mix model, and resulted in the elimination of 6 variables. Table 32 shows the six case-mix variables which failed to meet the $p < 0.2$ criteria in both the 3 and 12-month regressions and were subsequently eliminated from the final case-mix model. The p-values at the point of elimination from both regressions are also included. The most notable variable to be eliminated was the Lund-Mackay score. Once all other case-mix variables had been controlled for, Lund-Mackay scores did not predict post-operative SNOT-22 scores.

Table 33 shows the multivariate regression statistics produced by using the final case-mix model with the 3 and 12-month SNOT-22 scores. Complete data was available for 2,229 patients at 3-months, and the number of clusters (i.e. Consultants in charge of treatment) used to produce robust standard errors estimates was 277. The regression model was highly significant ($F = 44.2$: d.f. = 30, 276): $p < 0.001$) and explains about 33.3% of the variation in SNOT-22 scores.

Complete data was available for 2,200 patients at 12-months, and the number of clusters (i.e. Consultants in charge of treatment) used to produce robust standard errors estimates was 279. The regression model was again highly significant ($F = 55.2$: d.f. = 30, 278): $p < 0.001$) and explains about 37.3% of the variation in SNOT-22 scores.

6.1 Pre-operative SNOT-22 score

Pre-operative SNOT-22 score is a strong predictor of post-operative SNOT-22 score at both 3-months (coefficient = 0.49: $p < 0.01$) and 12-months (coefficient = 0.59: $p < 0.01$) having controlled for all other measured case-mix variables. Post-operative scores on the SNOT-22 measure tend to rise by about 0.5 to 0.6 points for every 1 point increase in the pre-operative SNOT-22 score.

6.2 Age

Age had a very small and non-significant influence on SNOT-22 scores at both 3-months (coefficient = -0.03: $p = 0.31$) and 12-months (coefficient = -0.04: $p = 0.20$). This is evidence for a weak beneficial effect of increasing age, with older patients having lower post-operative symptom levels.

6.3 Gender

Males tended to report lower post-operative SNOT-22 scores (and therefore lower symptom levels) than females although this effect was not significant at 3-months (coefficient = -1.45: $p = 0.09$) or 12-months (coefficient = -0.58: $p = 0.50$). Thus, males tend to score around 1.45 points lower than females on the SNOT-22 at 3-months, and 0.58 points lower at 12-months, having controlled for all other measured case-mix variables.

6.4 Patient reported asthma

Patients who report suffering from asthma tend to report higher post-operative SNOT-22 scores than those without asthma. This is not significant at 3-months (coefficient = 1.37: $p = 0.13$) but achieves significance at 12-months (coefficient = 2.60: $p < 0.01$).

6.5 Clinician reported aspirin sensitivity and lower respiratory tract infection

In patients where clinicians report aspirin sensitivity, risk adjusted post-operative SNOT-22 scores tended to be higher than in patients reported as not having aspirin sensitivity. However, this was not significant at 3-months (coefficient = 4.10: $p = 0.06$) or 12-months (coefficient = 3.21: $p = 0.15$).

Patients reported as having a lower respiratory tract infection at the time of surgery, tended to report lower post-operative SNOT-22 scores than patients reported as not having such an infection. This was not significant at 3-months (coefficient = -1.26: $p = 0.75$) but reached significance at 12-months (coefficient = -10.24: $p < 0.01$).

6.6 Symptom duration and previous sino-nasal surgery

Patients whose symptoms had been present for less than 1 year tended to report lower post-operative SNOT-22 scores than those whose symptoms had been present for longer periods. This effect was significant at 3-months (coefficient = -3.17: $p = 0.02$) but did not reach significance at 12-months (coefficient = -2.36: $p = 0.09$).

Previous sino-nasal surgery was associated with higher post-operative SNOT-22 scores (and therefore higher symptom levels) compared to those undergoing sino-nasal surgery for the first time. This effect was strong and present at both 3-months (coefficient = 4.24: $p < 0.01$) and 12-months (coefficient = 3.75: $p < 0.01$).

6.7 Polyp extent

All grades of polyp extent were associated with lower post-operative SNOT-22 scores in comparison to patients with no polyps. This was significant for all comparisons at both 3 and 12-months. Post-operative SNOT-22 scores tended to be lower with greater polyp extent, and the lowest scores at 12-months were achieved by patients with grade III/II polyps (coefficient = -10.93: $p < 0.01$) and by patients with grade III/III polyps (coefficient = -10.91: $p < 0.01$). Symptom scores were also lower in patients where no data on polyp extent was available, compared to patients with no polyps. This effect was strong and significant at both 3-months (coefficient = -7.44: $p < 0.01$) and 12-months (coefficient = -7.79: $p < 0.01$).

6.8 Previous medical treatments

Patients who had previously been prescribed sino-nasal medication tended to have higher post-operative SNOT-22 scores than those that had not been prescribed such medication. At 3-months this effect was observed at non-significant levels for topical steroids (coefficient = 0.94: $p = 0.37$), topical antihistamines (coefficient = 3.53: $p = 0.16$) and long-term antibiotics (coefficient = 2.45: $p = 0.06$), while a non-significant beneficial effect was observed for systemic steroids (coefficient = -1.93: $p = 0.09$). At 12-months, higher SNOT-22 symptom scores were observed at a significant level for topical steroids (coefficient = 2.27: $p = 0.04$), systemic steroids (coefficient = 3.26: $p = 0.02$), and at a non-significant level for topical antihistamines (coefficient = 1.69: $p = 0.46$) and long-term antibiotics (coefficient = 1.65: $p = 0.21$).

6.9 ASA grade

Patients with ASA grade 3-4 tended to report higher SNOT-22 scores than those with ASA grade 1 at both 3-months (coefficient = 6.66: $p < 0.01$) and 12-months (coefficient = 3.74: $p = 0.12$). Patients with no ASA grade data recorded also tended to report significantly higher SNOT-22 scores at 3-months (coefficient = 3.96: $p = 0.01$) but this effect was not apparent at 12-months (coefficient = 0.17: $p = 0.92$).

6.10 Purulent sinus infection at the time of surgery

Patients with purulent sinus infection at the time of surgery tended to have slightly lower SNOT-22 scores at 3-months (coefficient = -1.00: $p = 0.26$) and 12-months (coefficient = -1.36: $p = 0.17$) compared to those patients with no infection. This non-significant beneficial effect was also observed at both 3-months (coefficient = -1.99: $p = 0.09$) and 12-months (coefficient = -2.25: $p = 0.07$) for patients where no data on infection was recorded.

6.11 Carstairs deprivation index

Patients with higher deprivation scores tended to have higher post-operative SNOT-22 scores. This was non-significant at 3-months (coefficient = 0.17: $p = 0.19$) but reached significance at 12-months (coefficient = 0.37: $p = 0.01$).

6.12 Retrospective pre-operative form completion and time of post-operative form completion

Patients who completed their pre-operative assessments on a retrospective basis reported lower SNOT-22 scores at both 3-months (coefficient = -5.88: $p < 0.01$) and 12-months (coefficient = -6.41: $p < 0.01$) than patients who completed these forms on a prospective basis (i.e. before surgery).

As patients did not all complete their post-operative outcome assessment exactly 3 or 12-months after their original surgery, the influence of late form completion on SNOT-22 scores was explored. The length of time that had passed between surgery and post-operative form completion had a small and non-significant association with post-operative SNOT-22 scores at 3-months (coefficient = 0.09: $p = 0.15$) and 12-months (coefficient = 0.30: $p = 0.09$).

7. Comparison of health care provider outcomes

The risk-adjustment model presented in Chapter Six was used to make comparisons between health care provider outcomes and the figures observed at a national level. The following steps were taken:

1. 'Expected' SNOT-22 outcome scores were generated for each patient on the basis of the case-mix model presented in Chapter Six. These scores represented the outcomes we would expect to see for each patient given their pre-existing risk factors.
2. New multivariate linear regressions were then performed. These estimated for each healthcare provider (Trusts, hospitals and Consultants in charge of treatment) the difference ('O-E difference') between the observed SNOT-22 scores and the expected scores generated in step 1.
3. A negative O-E difference indicates that the healthcare provider in question has patients with post-operative SNOT-22 outcome scores that are lower than would be expected from the case-mix model. A positive O-E difference indicates that the healthcare provider in question has patients with post-operative SNOT-22 outcome scores that are higher than would be expected from the case-mix model. It should be born in mind here that lower scores represent lower symptom levels and better health outcomes, and thus negative O-E differences represent better outcomes than expected, and positive O-E differences represent worse outcomes than expected.
4. 95% confidence intervals and p-values for the O-E differences described in step 3 were calculated. Healthcare providers with observed outcomes that are significantly different from those that were expected (i.e. O-E differences with 95% confidence intervals that do not include zero) are noted in the analysis below.

Tables 34 to 37, and Figures 18 to 21 present the outcomes achieved by different healthcare providers at 3 and 12 months. The Figures allow healthcare providers to compare their data with the overall expected outcome levels as defined by the national distribution. The Tables present the observed SNOT-22 scores (i.e. unadjusted outcomes scores as reported by patients), the expected SNOT-22 scores (i.e. the scores one would have expected for an individual healthcare provider based on the case-mix of their patients), the relevant O-E differences and the 95% confidence intervals around the O-E differences. The data on expected outcomes may be of particular interest, as it provides information on the relative severity of cases operated upon by individual healthcare providers.

The Tables and Figures in this chapter do not contain data on healthcare providers that did not provide a sufficient number of cases (i.e. 10 or more patients) for meaningful analysis. It is not possible to group all of these results into one category (i.e. a 'low volume' group) given that some healthcare providers may simply have failed to submit all their eligible cases, and are not, in reality, low volume providers.

7.1 3-month SNOT-22 scores by Trust and hospital

SNOT-22 scores at 3-months by participating Trust (and by hospital where a Trust had more than one participating hospital) are available in Table 34 for the 74 Trusts and hospitals for whom full risk-adjusted outcomes data on more than 10 patients was available. Figure 18 shows the O-E differences at 3-months by participating Trust/hospital, compared to the overall levels expected as defined by the national distribution (0 on the x-axis). As lower O-E differences are associated with lower patient symptomatology, Trusts/hospitals to the right of the graph have achieved poorer patient outcomes. Again, the graph displays only those 74 Trusts and hospitals for whom full risk-adjusted outcomes data for more than 10 patients was available at 3-months. No Trust/hospital where full data on 10 or more

patients was available, had patients whose observed SNOT-22 scores were significantly worse than expected at 3-months. Two Trusts (Trust ID = t916; Trust ID = t965), where full data on 10 or more patients was available, had patients whose observed SNOT-22 scores were significantly better than expected at 3-months.

7.2 3-month SNOT-22 scores by Consultant in charge of treatment

SNOT-22 scores at 3-months by participating Consultant in charge of treatment are available in Table 35 for the 85 Consultants for whom full risk-adjusted outcomes data on more than 10 patients was available. Figure 19 shows the O-E differences at 3-months by participating Consultant, compared to the overall levels expected as defined by the national distribution (0 on the x-axis). As lower O-E differences are associated with lower patient symptomatology, Consultants to the right of the graph have achieved poorer patient outcomes. Again, the graph displays only those 85 Consultants for whom full risk-adjusted outcomes data for more than 10 patients was available at 3-months. One Consultant (Consultant ID = c977108), where full data on 10 or more patients was available, had patients whose observed SNOT-22 scores were significantly worse than expected at 3-months. One Consultant (Consultant ID = c933202), where full data on 10 or more patients was available, had patients whose observed SNOT-22 scores were significantly better than expected at 3-months.

7.3 12-month SNOT-22 scores by Trust and hospital

SNOT-22 scores at 12-months by participating Trust (and by hospital where a Trust had more than one participating hospital) are available in Table 36 for the 73 Trusts and hospitals for whom full risk-adjusted outcomes data on more than 10 patients was available. Figure 20 shows the O-E differences at 12-months by participating Trust/hospital, compared to the overall levels expected as defined by the national distribution (0 on the x-axis). As lower O-E differences are associated with lower patient symptomatology, Trusts/hospitals to the right of the graph have achieved poorer patient outcomes. Again, the graph displays only those 73 Trusts and hospitals for whom full risk-adjusted outcomes data for more than 10 patients was available at 12-months. One Trust (Trust ID = 910) where full data on 10 or more patients was available, had patients whose observed SNOT-22 scores were significantly worse than expected at 12-months. One Trust (Trust ID = t930), where full data on 10 or more patients was available, had patients whose observed SNOT-22 scores were significantly better than expected at 12-months.

7.4 12-month SNOT-22 scores by Consultant in charge of treatment

SNOT-22 scores at 12-months by participating Consultant in charge of treatment are available in Table 37 for the 85 Consultants for whom full risk-adjusted outcomes data on more than 10 patients was available. Figure 21 shows the O-E differences at 12-months by participating Consultant, compared to the overall levels expected as defined by the national distribution (0 on the x-axis). As lower O-E differences are associated with lower patient symptomatology, Consultants to the right of the graph have achieved poorer patient outcomes. Again, the graph displays only those 85 Consultants for whom full risk-adjusted outcomes data for more than 10 patients was available at 12-months. Two Consultants (Consultant ID = c909103; Consultant ID = c910103), where full data on 10 or more patients was available, had observed SNOT-22 scores that were significantly worse than expected at 12-months. One Consultant (Consultant ID = c952112), where full data on 10 or more patients was available, had observed SNOT-22 scores that were significantly better than expected at 12-months.

Figure 18 **Difference between observed and expected SNOT-22 scores at 3-months with 95% confidence intervals by Trust/hospital ID**

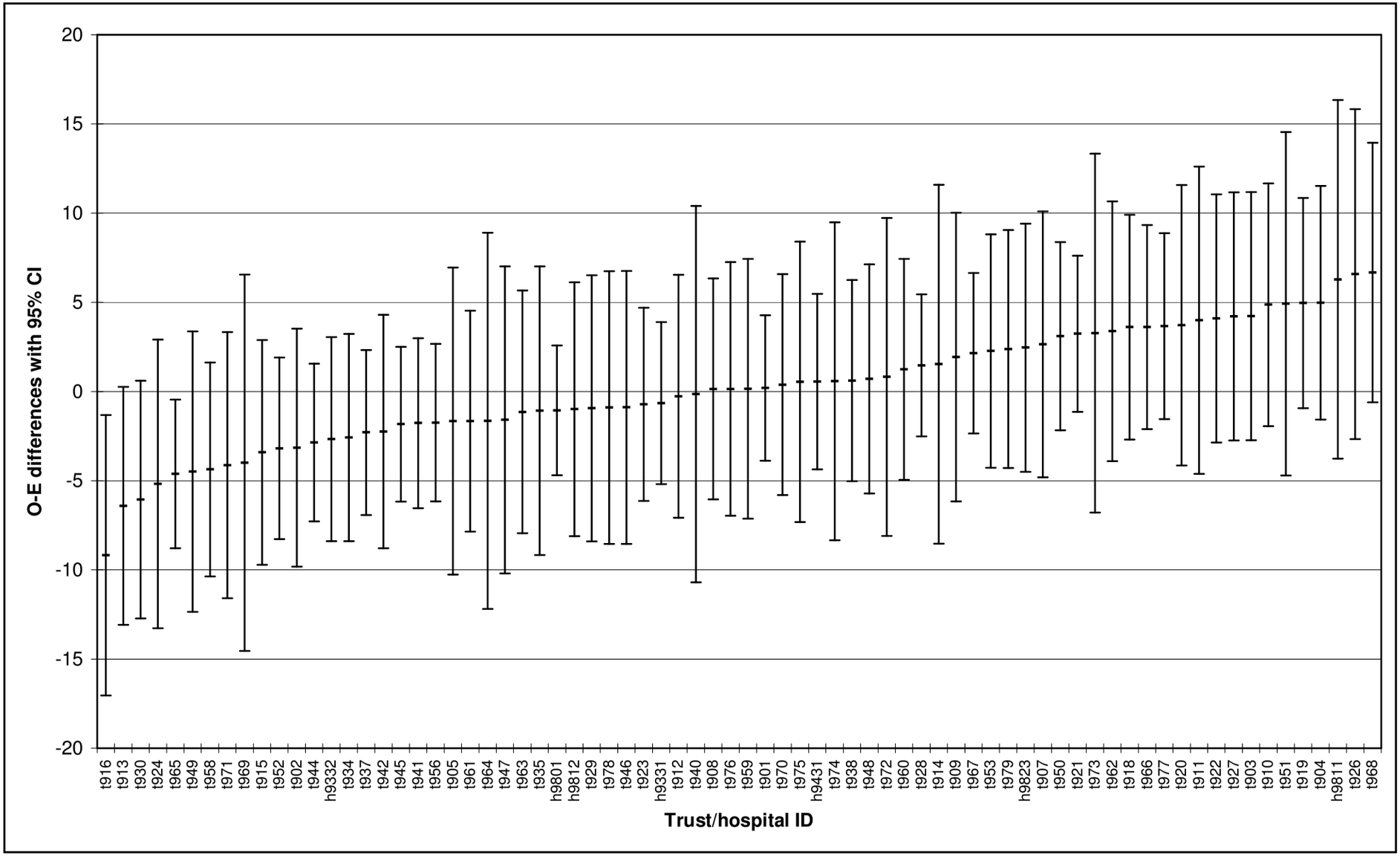


Figure 19 **Difference between observed and expected SNOT-22 scores at 3-months with 95% confidence intervals by Consultant ID**

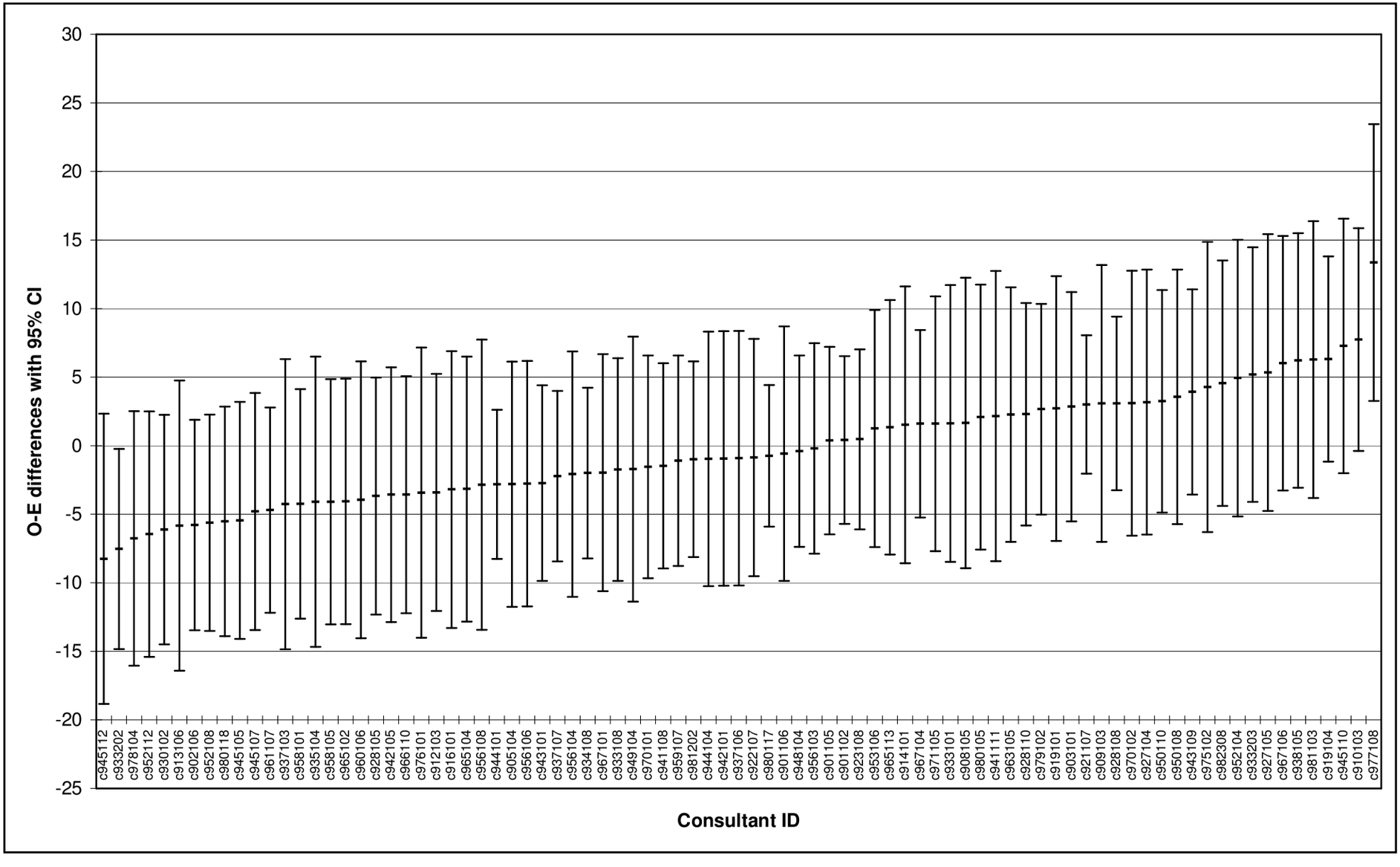


Figure 20 **Difference between observed and expected SNOT-22 scores at 12-months with 95% confidence intervals by Trust/hospital ID**

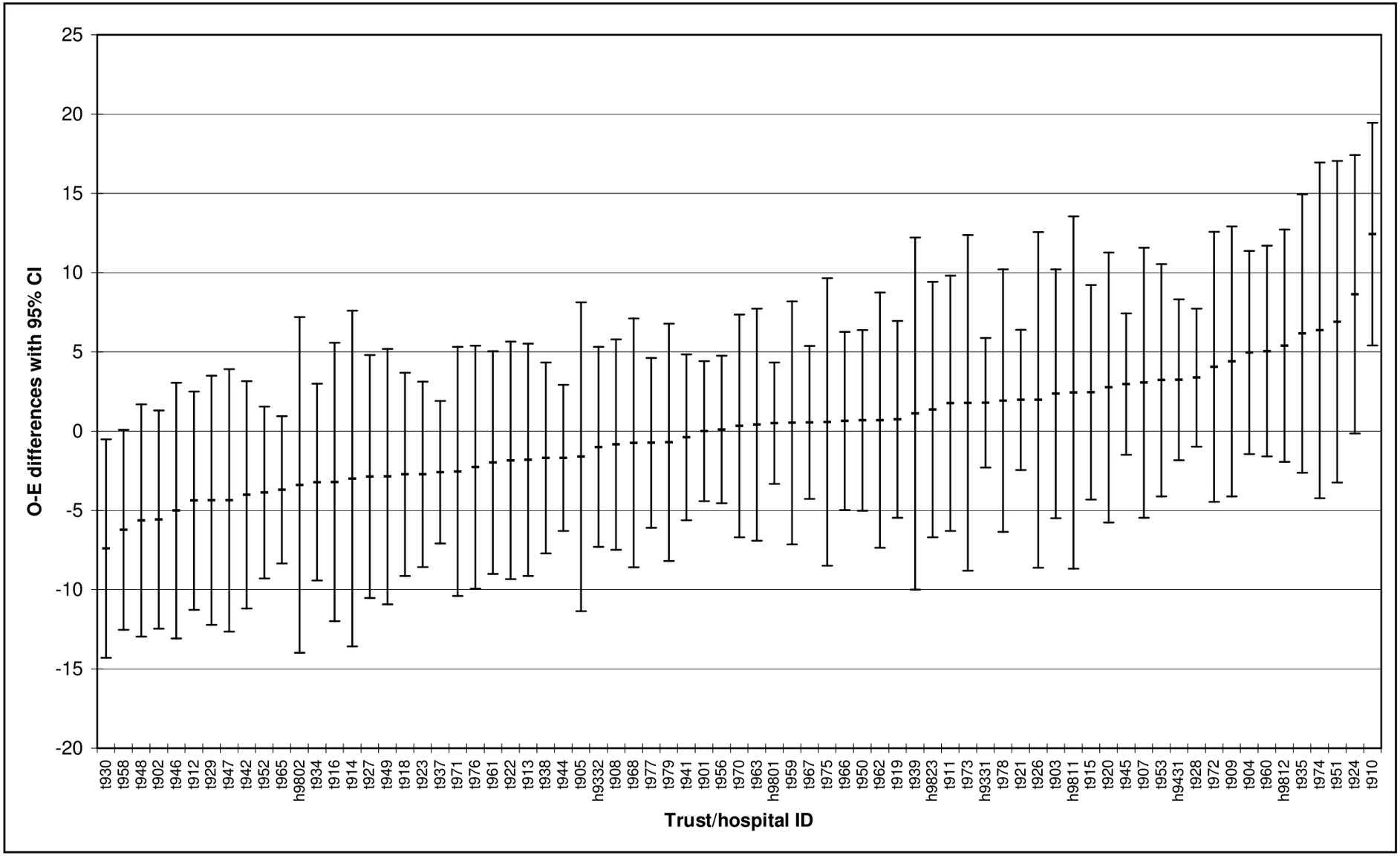
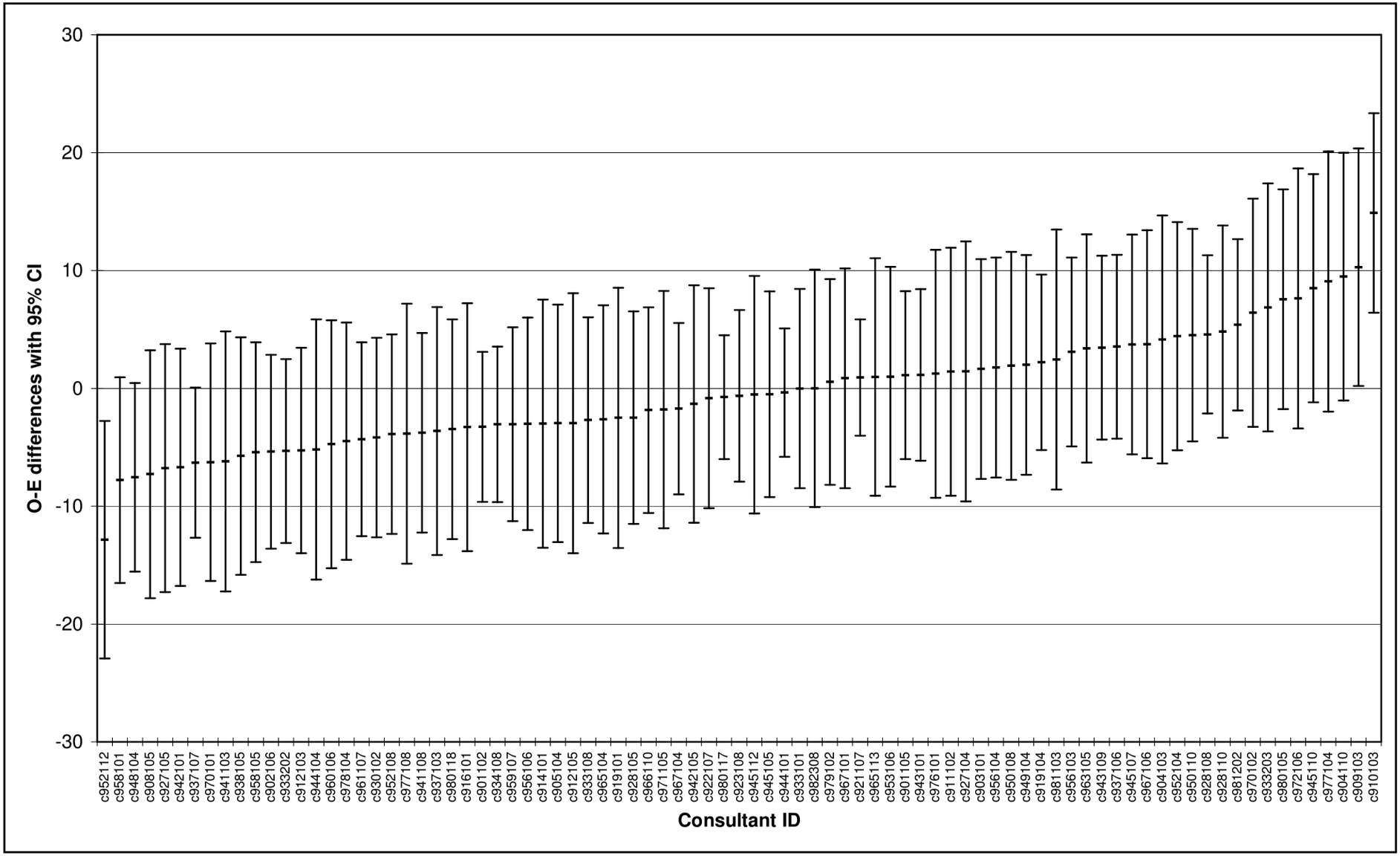


Figure 21 **Difference between observed and expected SNOT-22 scores at 12-months with 95% confidence intervals by Consultant ID**



8. Discussion and recommendations

8.1 Methodology

The National Audit of Sino-Nasal Surgery was a considerable success in terms of methodology. The project has succeeded in producing the largest dataset in the world on this type of surgical procedure. Clinical data was collected on 3128 patients, representing around 70% of all such procedures performed during a 6 month period in the year 2000 in England and Wales. A comprehensive range of case-mix, surgical and outcomes data was collected, and this data has acceptable validity.

It is worth considering the degree of co-operation observed among clinicians and patients in this audit. When offered the chance to participate in this audit, 90% of ENT Departments agreed to do so. At the patient level, around 82% of patients provided outcomes data during the 12-month follow up period, a figure which compares well with other studies of this type. By contrast, only 51% of all eligible Trusts participated in the audit, largely because of resistance at Trust management levels. Almost all of this management resistance was down to financial issues or local clinical governance policies. These figures indicate that the main block to participation in national comparative audit is often at the NHS management level, and has little to do with patient or clinician resistance to the activity. It is likely that a well planned and centrally financed national clinical audit programme would have the support of both clinicians and patients.

The project is also a good example of co-operation between clinicians and academics. At all stages of this project it was recognised that input from both sectors was essential. Clinicians were centrally involved in the definition of clinical questions, including the definition of relevant data items. The academics involved in the project were sensitive throughout to the need for a rigorous case-mix model which allows for fair comparison across healthcare providers. The participating ENT surgeons can be confident that the quality of care they provide has been accurately presented in this report. Crucially, they can be assured that audits of this type do not introduce perverse incentives into their work place (e.g. the need to avoid treating patients with severe disease).

Finally, this project represents an important mechanism for ENT surgeons to participate in national comparative audit. Despite a recognition amongst both clinicians and managers that this type of activity is a cornerstone of clinical governance, there remain relatively few opportunities for surgeons to compare their performance with their peers. This is particularly true of elective surgery with low mortality rates. It is to be hoped that support from central government for projects of this type will grow in future years.

8.2 Patient case-mix

Important information on the current case mix of patients undergoing sino-nasal surgery in England and Wales has been presented in this report. While the basic demographic make up of the sample (e.g. age, gender) will not surprise many readers, there are some important findings with regard to patient disease status and symptomatology that will require further attention.

Nearly one-third of patients undergoing sinus surgery had clinician-rated Lund Mackay scores less than 4 (i.e. lower than the estimated average for the normal population), and 3.9% of patients underwent surgery in the virtual absence of symptoms as recorded on the SNOT-22 questionnaire. In addition, 8.3% of patients underwent surgery less than a

year after their symptoms had begun. These findings suggest that there are issues surrounding the selection of patients for sino-nasal surgery that require further examination. It is important to recognise that the effectiveness of surgery is difficult to demonstrate when some patients seem quite healthy on the relevant outcome measure *before* surgery.

A further finding of note is the very high proportion of patients who have had previous sino-nasal surgery (46%). This is a strikingly high proportion, and underlines the non-curative nature of this surgery for many patients.

8.3 Clinical practice

A consistent finding in this audit has been the heterogeneity of surgical techniques practised within sino-nasal surgery. Operations can and do vary along a number of dimensions particularly distal extent of surgery and use of endoscope. This variation is not due simply to surgeon preference as there is evidence that practice is matched closely to patient characteristics. This is particularly true of polyp extent, which is a strong predictor of clinical practice. Lund-Mackay scores are also important, but there is less evidence that clinicians use patient symptom status to determine practice. Finally, the audit reveals that extensive surgery is rarely performed without cross-sectional imaging, and that Consultants tend to operate on those with the most extensive disease on cross-sectional imaging. Again these findings are evidence that the patient's pre-operative findings play a strong role in determining surgical practice.

The audit has also revealed some variations in practice across healthcare providers that may require further attention. The rate of day case surgery in different Trusts, for example, ranges from 0% to 100%. The mean patient pre-operative SNOT-22 score varies from less than 30 in some Trusts to more than 50 in other Trusts, indicating considerable variation in clinician thresholds for surgery.

8.4 Outcomes

The audit confirms that sino-nasal surgery is generally effective. Greater benefit is accrued to patients undergoing polyp procedures, particularly those with the greatest obstruction. These findings tally with the impressions of the clinicians on the audit steering group: nasal polypectomy for gross obstruction is a generally beneficial procedure which offers great symptom relief in the short term. Patients are generally quite satisfied with their surgery and 56.7% of all patients consider their symptoms to be 'much better' 12 months after the operation.

The audit also confirms that sino-nasal surgery is very safe with a small number of perioperative adverse events recorded. There is also very little disruption associated with the surgery, with a median in-patient stay of only one day, and most patients returned to their normal life activities within two weeks.

Patients that underwent sinus surgery accrued significantly less benefit than other patients in this audit. At 12-months, 31.9% of these patients rated their symptoms as the same or worse than at the time of their operation. For these patients it is clear that sinus surgery is not always successful.

While sino-nasal surgery is generally not very disruptive, a surprisingly high proportion of patients complain of pain in the perioperative period. It is particularly surprising that 28.2% of patients complain of some pain during their operation. This may be due to a misinterpretation of the question by patients: many may have interpreted this as referring to the period around the operation rather than actually during the operation. However, the findings on pain in

the first 24 hours after the operation are also a little worrying (e.g. 36.9% complain of moderate or severe pain) and in conjunction these findings may indicate issues around pain control that require further attention.

An important determinant of outcome in patients with sino-nasal conditions is medication. A drawback of this project is the lack of detailed data on the previous medical regimes which these patients have undergone. Data on the post-operative medication regimes has been collected prospectively and we intend to carry out further analyses on the effectiveness of these regimes. However, the interpretation will continue to be difficult in a non-randomised design such as this audit. Medication use in patients that have undergone sino-nasal surgery may be indicative of surgical failure, or may be part of a routine post-operative regime, and disentangling these causes may not be possible.

Finally, 3.7% of patients had undergone revision surgery for their nasal or sinus symptoms within 12-months of the original procedure, with a further 5.0% of patients on a waiting list for revision surgery. Further follow-up of these patients will confirm the rate of revision surgery, with follow-up contact underway for 3 year outcomes and planned for 5 year outcomes.

8.5 Risk-adjusted outcomes

The risk adjustment modelling carried out for this audit suggests that pre-operative symptom status is an excellent predictor of post-operative outcome. It is recommended that routine use of the SNOT-22 be adopted in future audit of sino-nasal surgery.

The other case-mix variables which have a major influence on patient SNOT-22 scores are previous sino-nasal surgery (higher post-operative symptom levels seen in these patients) and extent of polyposis (lower post-operative symptom levels observed in patients with greater polyp extent, when compared to patients with no polyps). These results are to be expected: recurrent surgery is generally associated with poorer outcomes, and the extraction of grossly obstructive polyps is likely to be associated with greater symptom relief.

A surprising finding is the low predictive value of the Lund-Mackay staging system for sinus disease. In general, it seems as though the Lund-Mackay score and patient reported symptoms (i.e. the SNOT-22) have only a weak association. Further exploration of the psychometric and clinimetric properties of both measures is required.

8.6 Comparative audit

This audit has shown that almost all NHS Trusts and Consultants are performing within the 95% confidence limits of the national distribution at 3 and 12-months. A very small number of Trusts and Consultants are 'underperforming' in statistical terms. It is important to remember that when using 95% confidence intervals one should expect 5% of healthcare providers to fall outside the national standard on the basis of chance alone (i.e. even if their 'true' performance does not differ from the national standard). Over time one would expect these healthcare providers to assume less extreme positions within the distribution. Indeed within the current audit there is evidence that this has happened, with some healthcare providers assuming quite different positions within the distribution at 12-months compared to 3-months. Of course it is also possible that the healthcare providers identified as falling outside the national standard are ‘true’ outliers and are achieving clinical outcomes (worse of better than their peers) that require further investigation.

In addition, the study was not designed (i.e. statistically powered) to facilitate comparisons across Consultants. The sample sizes for individual Consultant results as presented in Tables 35 and 37 are generally quite small, with samples of greater than 30 patients quite rare. For more than 200 individual Consultants, full results on 10 or more patients were not available, making any attempt at meaningful statistical comparison impossible. Consultants (and indeed Trusts) that submitted a large number of cases for audit are subject to more intense scrutiny, given that more precise estimates (i.e. more narrow confidence intervals) of their patient outcomes are available. The audit steering group is concerned that Consultants and Trusts that engage fully in the comparative audit process are not unfairly punished for doing so. The healthcare provider results in this report (particularly those at Consultant level) should be considered only tentative estimates of performance, and do not, in isolation, provide a firm basis for decisions about the competence of an individual healthcare provider.

The audit steering group is determined to ensure that a cautious approach is taken to the interpretation of the comparative audit data presented in this report. It is essential that knee jerk reactions are avoided so that unwarranted actions can be avoided. Healthcare providers with outcomes data that are statistically worse than the limits set by the national sample should also proceed in a cautious fashion, preferably in conjunction with the CEU and the audit steering group.

The audit steering group is of the opinion that no single healthcare provider studied in the audit is achieving outcomes that are of obvious concern and pose a clear danger to patients. The first step for any healthcare provider with concern about their outcomes is to liaise with the CEU so that further interrogation and analysis of their data can be undertaken. If concern persists then the Consultant, hospital or Trust can request support from the British Association of Otorhinolaryngologists, who, in conjunction with the Royal College of Surgeons of England, can provide a discrete and supportive external review. The aim of such a review would be to determine the nature and severity of any problems, and to develop a collaborative strategy for resolution of these problems.

Although this study was 'powered' from a statistical point of view, case ascertainment across Trusts was variable. This lead to low sample sizes for some Trusts, and as a consequence a low power to detect performance outside the national standard. Hopefully, a sino-nasal minimum dataset will be defined on *inter alia* the basis of the results of this report. Routine collection of this data set across ENT Departments would ensure the power to detect deviant performance on an ongoing basis.

8.7 The future of this audit

The dataset compiled in the course of this audit has the potential to address a number of important issues in sino-nasal surgery. The CEU in conjunction with the British Association of Otorhinolaryngologists – Head and Neck Surgeons Comparative Audit Group will address these issues in the next 12 months with a view to the dissemination of findings through peer reviewed journals.

The first future project will be the long-term follow up of the patient cohort. Three year follow-up, concentrating on patient symptomatology and new sino-nasal surgery, has commenced and will be completed in Spring 2004. Five year follow-up of the cohort is also planned.

A second project will examine the psychometric and clinimetric properties of the SNOT-22 outcome measure. There are suggestions that the measure may contain a number of redundant items, and this possibility will be examined. It is

also possible that the measure does not address some symptoms that are of relevance when, for example, patients are listed for sino-nasal surgery. It is hoped that this research will lead to the development of a 'definitive' patient based outcome measure for sino-nasal surgery, that can be accepted as the 'gold standard' by patients, clinicians and researchers.

A third project will examine important effectiveness issues in sino-nasal surgery. Data on many aspects of clinical practice was collected in the audit, and this provides the opportunity to examine the relationship between variations in practice in variations in outcome. Four separate issues have been identified and will be addressed in multivariate analysis: the importance of grade of operator; the influence of illumination technique (i.e. endoscope versus headlamp); the value of different removal instruments (e.g. debrider versus forceps); and the influence of distal extent of surgery on outcome.

Finally, the influence of organisational variables, (e.g. training and supervision arrangements) have not yet been addressed in this audit. Non-randomised studies are always subject to residual confounding, and variables other than those collected in this study may have influenced the outcomes observed. The collection of important organisational data is planned for a future study, and it is hoped that this data will facilitate multi-level modelling of the outcomes data collected to date.

9. References

1. NHS Executive Consultation Document. A First Class Service - Quality in the new NHS. 1998.
2. NHS Executive Health Service Circular 1999/065. Clinical Governance: Quality in the new NHS. 1999.
3. Department of Health. Clinical Governance Reporting Processes Guidance. 2002.
4. Larsen K. The clinical relationship of nasal polyps to asthma. Allergy Asthma Proc 1996; 17: 243-9
5. Larsen K, Tos M. The estimated incidence of symptomatic nasal polyps. Acta Otolaryngol 2002; 122:179-82.
6. Larsen K, Tos M. A long-term follow-up study of nasal polyp patients after simple polypectomies. Eur Arch Otorhinolaryngol Suppl 1997; 1: S85-8.
7. Dalziel K, Stein K, Round A, Garside R, Royle P Functional Endoscopic sinus surgery for nasal polyps. NHS R&D HTA Report, 2002
8. Kazis LE, Anderson JJ, Meenan RF (1989) Effect sizes for interpreting changes in heath status. Med Care 27: S178-89.
9. Piccirillo JF, Merritt MG Jr, Richards ML. Psychometric and clinimetric validity of the 20-Item Sino-Nasal Outcome Test (SNOT-20). Otolaryngol Head Neck Surg 2002 126: 41-7.
10. Rockall TA, Logan RFA, Devlin HB, Northfield TC, for the National Audit of Acute Upper Gastrointestinal Haemorrhage. Variation in outcome after acute upper gastrointestinal haemorrhage. Lancet 1995; 346: 346-50.
11. Emberton M, Neal DE, Black N, et al. The National Prostatectomy Audit: the clinical management of patients during admission. Br J Urol 1995; 75: 301-316.
12. Ware JE, Kosinski M, Dewey JE. How to score version of SF-36 health survey. 2000. QualityMetric Incorporate: Lincoln, Rhode Island.
13. Lund VJ, MacKay IS. Staging in rhinosinusitis. Rhinology 1993; 107: 183-4.
14. Moloney JR. Nasal polyps, nasal polypectomy, asthma and aspirin sensitivity: their association in 445 cases of nasal polyps. J Laryngol Otol 1977; 91: 837-46.
15. Benninger MS, Anon J, Mabry RL. The medical management of rhinosinusitis. Otolaryngol Head Neck Surg. 1997; 117: S41-9.
16. Upton MN, McConnachie A, McSharry C et al. Intergenerational 20 year trends in the prevalence of asthma and hay fever in adults: the Midspan family study surveys of parents and offspring. BMJ 2000; 321: 88-92.
17. Vally H, Taylor ML, Thompson PJ. The prevalence of aspirin intolerant asthma (AIA) in Australian asthmatic patients. Thorax 2002; 57: 569-74
18. Department of Health. Statistical Bulletin. 2000; 17. Department of Health.
19. Ahraf N, Bhattacharyya N. Determination of the incidental Lund-Mackay score for the staging of chronic rhinosinusitis. Otolaryngol Head Neck Surg 2001; 125: 483-6
20. Lund VJ, Kennedy DW. Staging for Rhinosinusitis. Otolaryngol Head Neck Surg 1997; 117: S35 – S40.

Table 1 Variables collected during the National Audit of Sino-Nasal Surgery

Health-care provider detail	Case-mix data	Treatment details	Outcomes data
Name of Trust responsible for operation	Patient reported pre-operative SNOT-22 score	Sino-nasal imaging carried out before the operation	Patient reported 3 month SNOT-22 score
Name of hospital where operation took place	Age	Form of anaesthesia used	Patient reported 12-month SNOT-22 score
Name of Consultant in charge of treatment	Sex	Instrumentation used during the operation	Adverse events during the operation
Name of main operator during surgery	Patient-reported asthma	Procedures performed during the operation	Pain experienced during the operation, in the first 24 hours after the operation and in the first week after the operation
Grade of main operator during surgery	Patient-reported allergies	Surgical approach used	Patient reported bleeding problems after discharge
Most senior grade present in the operating theatre	Patient-reported smoking behaviour	Preparations used during the operation	Visits to the family doctor regarding sino-nasal problems in the first 3 months post surgery, and the subsequent 9 months
	Clinician reported otitis media, aspirin sensitivity and lower respiratory tract infection at time of surgery	Packing inserted at time of surgery, and planned removal time for packing	Re-admissions to hospital for sino-nasal problems in the first 3 months post surgery
	Patient reported time since symptoms first appeared	Length of stay	Patient satisfaction with information about the operation
	Patient reported previous sino-nasal surgery	Type of information provided to patient about the operation	Patient satisfaction with information about future treatment after surgery
	Patient reported general health	Type of information provided to patient about future treatment after surgery	Time to return to normal work, social and leisure activities
	Clinician rated polyp extent	Steroid medication used in the first 3 months after surgery	Patient rating of current symptoms at 3 and 12-months compared to pre-operative status
	Clinician reported previous treatment with topical steroids, topical antihistamines, systemic steroids, systemic antihistamines, long-term antibiotics	Other medication used in the first 3 months after surgery	Patient rating of general health at 3 months and 12-months
	ASA grade	Medication used in the period 4-12-months after surgery	Patient rating of results of the operation at 3 and 12-months
	Purulent sinus infection at surgery		Patient rating at 3 and 12-months of willingness to have the operation again if symptoms returned
	Clinician-rated Lund-Mackay score		Patient rating at 3 and 12-months of operation results compared to expectations
	Carstairs deprivation index based on postcode		Perioperative adverse events as reported by the operating surgeon

Table 2 Case ascertainment estimates by Trust ID

Trust ID	Number of polypectomies reported to CEU	% of eligible polypectomies reported to CEU (using HES denominator)	Number of all cases reported to CEU	% of eligible cases reported to CEU (intensive queries)
t901	55	64.7%	78	n/a
t902	14	100%	31	81.6%
t903	22	71.0%	31	79.5%
t904	35	100%	44	100%
t905	5	50.0%	15	n/a
t906	4	25.0%	7	n/a
t907	14	93.3%	24	57.1%
t908	33	68.8%	41	65.1%
t909	18	47.4%	20	n/a
t910	15	60.0%	33	n/a
t911	14	100%	25	100%
t912	24	49.0%	32	n/a
t913	16	45.7%	30	51.7%
t914	10	100.0%	14	87.5%
t915	25	71.4%	36	n/a
t916	19	95.0%	26	76.5%
t918	33	50.0%	39	40.6%
t919	28	84.8%	39	n/a
t920	14	66.7%	19	n/a
t921	60	92.3%	73	92.4%
t922	25	67.6%	32	n/a
t923	28	75.7%	57	n/a
t924	18	51.4%	21	75.0%
t926	13	39.4%	18	34.0%
t927	18	100%	25	92.6%
t928	47	90.4%	89	95.7%
t929	21	100%	26	100%
t930	24	53.3%	39	n/a
t931	4	100%	6	n/a
t932	5	55.6%	6	n/a
t933	91	71.1%	158	n/a
t934	36	40.4%	38	n/a
t935	10	100%	19	n/a
t936	6	75.0%	10	n/a
t937	58	53.2%	85	n/a
t938	28	100%	43	n/a
t939	7	22.6%	13	n/a
t940	8	27.6%	12	n/a
t941	65	86.7%	66	74.2%
t942	21	84.0%	35	n/a
t943	52	89.7%	72	88.9%
t944	19	90.5%	75	n/a
t945	61	69.3%	84	67.2%
t946	21	43.8%	25	n/a
t947	11	73.3%	22	91.7%
t948	19	52.8%	31	60.8%
t949	19	47.5%	25	51.0%
t950	46	31.9%	61	n/a
t951	10	83.3%	14	73.7%
t952	21	53.8%	50	64.1%
t953	27	79.4%	33	63.5%
t954	5	71.4%	7	n/a
t955	9	11.0%	9	n/a
t956	62	100%	108	98.2%
t957	12	28.6%	16	n/a
t958	15	100.0%	49	90.7%
t959	23	27.7%	31	n/a
t960	16	37.2%	43	n/a

t961	23	44.2%	38	n/a
t962	14	41.2%	26	n/a
t963	17	48.6%	29	90.6%
t964	3	30.0%	10	n/a
t965	62	91.2%	78	95.1%
t966	54	61.4%	81	n/a
t967	39	100%	88	83.0
t968	17	32.1%	28	n/a
t969	10	76.9%	14	77.8%
t970	24	96.0%	36	n/a
t971	22	71.0%	25	n/a
t972	31	75.6%	36	51.4%
t973	11	50.0%	15	55.6%
t974	12	15.4%	25	n/a
t975	20	35.1%	21	n/a
t976	21	100%	27	n/a
t977	47	100%	76	n/a
t978	16	50.0%	23	n/a
t979	24	75.0%	33	80.5%
t980	82	54.7%	130	n/a
t981	24	100%	40	88.9%
t982	27	87.1%	39	n/a
National	2039	67.0%	3128	77.0%

Table 3 Results of data validation exercise

Data item	Number of errors	%
Patient date of birth	20	2.7
Patient gender	5	0.7
Main operator name	22	3.0
Consultant in charge name	16	2.2
Date of operation	22	3.0
Previous medical treatments	42	5.8
Clinician rated comorbidities	169	23.2
ASA grade	45	6.2
Form of anaesthesia	27	3.7
Procedures performed	43	5.9
Extent of polypi	24	3.3
Adverse events	60	8.2

Table 4 Characteristics of all patients included in the audit.

	Polyp removal (%) (N = 2039)	Sinus only (%) (N = 1089)	All operations (%) (N = 3128)
Mean age in years (range)	52.3 (17-94 years)	43.9 (16-81 years)	49.5 (16-94 years)
Less than 40 years	456 (22.4)	448 (41.3)	904 (29.0)
40-59 years	954 (46.9)	468 (43.1)	1422 (45.5)
60 years or more	626 (30.7)	170 (15.7)	796 (25.5)
Male	1399 (68.7)	486 (44.7)	1885 (60.4)
Mean Carstairs deprivation index (range)	0.28 (-4.8-17.2)	-0.05 (-5.0-15.3)	0.17 (-5.0-17.2)
Duration of symptoms (patient report)			
Began within the last year	157 (8.5)	77 (7.9)	234 (8.3)
Began 1-5 years ago	648 (35.1)	417 (42.7)	1065 (37.7)
Began more than 5 years ago	1043 (56.4)	482 (49.4)	1525 (54.0)
Previous sino-nasal surgery (patient report)	966 (52.0)	342 (35.0)	1308 (46.1)
Median years since last operation (range)	6 (1-60)	5 (1-52)	6 (1-60)
Previous medical treatment			
Any steroids	1720 (86.3)	882 (83.4)	2602 (85.3)
Topical steroids	1702 (85.4)	876 (82.9)	2578 (84.5)
Systemic steroids	361 (18.1)	61 (5.8)	422 (13.8)
Topical antihistamines	50 (2.5)	36 (3.4)	86 (2.8)
Systemic antihistamines	173 (8.7)	122 (11.5)	295 (9.7)
Long term antibiotics	136 (6.8)	204 (19.3)	340 (11.1)
Comorbidities			
Asthma (patient report)	714 (38.5)	206 (21.1)	920 (32.5)
Allergies (patient report)	653 (36.1)	368 (38.3)	1021 (36.8)
Otitis media	28 (1.4)	15 (1.4)	43 (1.5)
Lower respiratory tract infection	14 (0.7)	7 (0.6)	21 (0.7)
Aspirin sensitivity	104 (5.1)	10 (0.9)	114 (3.8)
Cystic fibrosis	3 (0.2)	0 (0)	3 (0.1)
Purulent sinus infection at surgery	394 (21.1)	213 (21.4)	607 (21.2)
ASA grade			
1	1064 (55.9)	768 (75.1)	1832 (62.6)
2	749 (39.3)	230 (22.5)	979 (33.4)
3	88 (4.6)	24 (2.3)	112 (3.8)
4	3 (0.2)	1 (0.1)	4 (0.1)
5	0 (0)	0 (0)	0 (0)
Cigarettes smoked per day (patient report)			
None	1510 (82.4)	725 (74.7)	2235 (79.7)
1-9	156 (8.5)	121 (12.5)	277 (9.9)
10-20	136 (7.4)	99 (10.2)	235 (8.4)
More than 20	31 (1.7)	26 (2.7)	57 (2.0)
General health rating (patient report)			
Excellent	157 (8.6)	73 (7.5)	230 (8.2)
Very good	636 (34.7)	369 (38.0)	1005 (35.8)
Good	746 (40.7)	368 (37.9)	1114 (39.7)
Fair	245 (13.4)	133 (13.7)	378 (13.5)
Poor	50 (2.7)	27 (2.8)	77 (2.7)

Table 5 Extent of polyposis in patients undergoing polypectomies

Extent	N	%
Grade I/0: Confined to middle meatus on one side, none on other side	149	7.5
Grade I/I: Confined to middle meatus on both sides	356	17.9
Grade II/0: Below level of middle turbinate on one side, none on other side	126	6.3
Grade II/I: Below level of middle turbinate on one side, confined to middle meatus on other side	139	7.0
Grade II/II: Below level of middle turbinate on both sides	541	27.2
Grade III/0: Total obstruction on one side, none on other side	61	3.1
Grade III/I: Total obstruction on one side, confined to middle meatus on other side	55	2.8
Grade III/II: Total obstruction on one side, below level of middle turbinate on other side	126	6.3
Grade III/III: Total obstruction on both sides	440	22.1
Total*	1993	100

* Data for 46 polypectomy patients not recorded

Table 6 Lund-McKay score by extent of polyposis in patients undergoing polypectomies

Extent of polyposis	N	Mean	95% CI
Grade I/0	81	7.8	6.9-8.7
Grade I/I	241	12.1	11.4-12.7
Grade II/0	42	7.5	6.1-8.8
Grade II/I	66	11.7	10.6-12.8
Grade II/II	260	15.0	14.3-15.7
Grade III/0	22	7.4	5.8-9.0
Grade III/I	24	12.8	10.2-15.4
Grade III/II	42	17.3	15.5-19.2
Grade III/III	199	18.1	17.2-19.0
Total*	977	13.6	13.2-14.0

* data for 1062 patients undergoing polyp procedures not available, due to Lund-Mackay score not performed or polyp rating not performed

Table 7 Unadjusted pre-operative SNOT-22 scores by participating Trust and hospital

Trust ID	N	Mean	Lower 95% CI	Upper 95% CI
t901	77	38.51	33.75	43.27
t902	31	39.37	32.96	45.78
t903	27	42.92	34.72	51.12
t904	35	40.43	33.51	47.36
t905	15	52.50	43.30	61.70
t906	7	53.71	36.87	70.55
t907	24	32.40	25.31	39.50
t908	36	42.24	35.18	49.30
t909	20	39.17	30.20	48.15
t910	32	39.52	33.43	45.61
t911	22	42.30	33.25	51.35
t912	30	39.71	31.92	47.49
t913	28	46.66	37.97	55.36
t914	14	44.32	33.03	55.60
t915	35	49.08	41.97	56.18
t916	19	38.02	29.20	46.84
t918	38	46.43	39.04	53.81
t919	37	41.30	33.95	48.65
t920	19	46.87	37.10	56.65
t921	70	40.48	35.54	45.41
t922	29	47.17	41.00	53.35
t923	45	44.00	37.05	50.96
t924	20	47.91	35.52	60.29
t926	17	40.76	31.87	49.64
t927	25	47.00	39.19	54.82
t928	83	38.09	34.43	41.76
t929	22	43.33	33.58	53.08
t930	29	41.02	34.25	47.79
t931	6	44.63	22.12	67.15
t932	6	37.55	23.22	51.88
*h9331	85	40.42	35.77	45.06
*h9332	45	40.65	34.70	46.60
t934	38	44.70	38.02	51.37
t935	19	37.64	32.24	43.03
t936	9	46.68	33.37	59.99
t937	73	38.65	34.40	42.90
t938	42	34.75	29.38	40.12
t939	11	49.40	33.88	64.91
t940	12	32.67	23.27	42.07
t941	65	41.03	35.83	46.23
t942	29	41.49	33.37	49.60
*h9431	56	39.45	34.32	44.58
*h9432	6	47.52	24.08	70.95
t944	73	46.89	42.17	51.60
t945	81	39.65	35.07	44.23
t946	25	38.75	29.13	48.37
t947	21	41.89	31.22	52.57
t948	29	35.85	30.08	41.62
t949	23	52.18	40.12	64.25
t950	47	38.20	33.06	43.34
t951	14	49.59	39.98	59.21
t952	49	45.89	40.36	51.42
t953	30	36.81	29.71	43.90
t954	7	41.29	27.44	55.13
t955	3	27.13	4.22	50.05
t956	85	43.25	38.49	48.01
t957	3	72.33	2.76	141.90
t958	35	44.93	36.82	53.04
t959	25	48.21	40.59	55.83
t960	41	45.14	37.87	52.41

t961	37	39.50	32.63	46.36
t962	25	43.62	33.71	53.53
t963	29	34.23	27.36	41.10
t964	10	44.93	29.31	60.56
t965	76	44.81	40.01	49.61
t966	51	40.08	35.25	44.91
t967	75	38.73	34.29	43.17
t968	28	44.53	36.77	52.28
t969	14	37.25	27.08	47.43
t970	34	41.72	35.01	48.43
t971	25	40.68	33.32	48.03
t972	27	43.06	35.39	50.72
t973	13	52.80	37.88	67.71
t974	19	49.73	38.46	61.00
t975	21	38.50	28.42	48.58
t976	27	38.96	31.00	46.92
t977	57	38.17	32.98	43.35
t978	22	47.12	37.37	56.87
t979	32	38.46	31.43	45.50
*h9801	112	47.15	43.22	51.08
*h9802	14	44.32	36.02	52.61
*h9811	14	46.42	33.82	59.02
*h9812	26	37.29	29.31	45.26
*h9821	5	25.5	2.08	48.92
*h9822	2	49.17	-63.07	161.40
*h9823	28	46.42	39.22	53.62
*h9824	1	44.0	n/a	n/a
National	2803	41.96	41.21	42.71

*Codes beginning with 'h' indicate hospital level data. This is provided when a Trust had more than one participating hospital. Codes beginning with 't' indicate Trust level data where only one hospital provided data within a Trust.

Table 8 Pre-operative SNOT-22 score by key patient characteristics.

	Polyp removal (N = 1836)		Sinus only (N = 967)		All operations (N = 2803)	
	N	Mean (95% CI)	N	Mean (95% CI)	N	Mean (95% CI)
Age						
Less than 40 years	409	44.6 (42.6-46.5)	403	42.7 (40.9-44.6)	812	43.7 (42.3-45.0)
40-59 years	871	42.5 (41.2-43.9)	407	45.9 (43.8-48.0)	1278	43.6 (42.5-44.7)
60 years or more	555	36.1 (34.5-37.7)	157	40.7 (37.4-44.0)	712	37.1 (35.7-38.5)
Gender						
Male	1259	38.2 (37.1-39.2)	424	38.3 (36.4-40.1)	1683	38.2 (37.3-39.1)
Female	576	47.2 (45.4-48.9)	542	48.1 (46.3-49.8)	1118	47.6 (46.4-48.8)
Extent of polyposis						
Grade I/0	129	37.9 (34.3-41.5)	n/a		n/a	
Grade I/I	314	41.4 (39.1-43.6)	n/a		n/a	
Grade II/0	112	34.1 (30.4-37.8)	n/a		n/a	
Grade II/I	126	39.2 (35.7-42.8)	n/a		n/a	
Grade II/II	498	41.3 (39.5-43.1)	n/a		n/a	
Grade III/0	59	37.4 (32.7-42.0)	n/a		n/a	
Grade III/I	49	36.7 (30.9-42.4)	n/a		n/a	
Grade III/II	116	38.9 (35.9-41.9)	n/a		n/a	
Grade III/III	396	45.3 (43.3-47.2)	n/a		n/a	
Lund-Mackay score						
0-4 points	78	37.5 (33.2-41.8)	264	43.1 (40.7-45.4)	342	41.8 (39.7-43.9)
5-9 points	146	42.0 (38.6-45.4)	271	44.4 (41.9-46.8)	417	43.5 (41.5-45.5)
10-14 points	278	41.4 (39.1-43.7)	185	45.0 (41.9-48.1)	463	42.8 (41.0-44.7)
15 or more points	389	45.6 (43.6-47.6)	42	44.9 (37.8-52.0)	431	45.5 (43.6-47.4)
Duration of symptoms						
Began < 1 year ago	149	33.8 (30.7-36.9)	77	39.4 (34.4-44.3)	226	35.7 (33.0-38.3)
Began 1-5 years ago	638	39.8 (38.3-41.4)	409	42.8 (40.9-44.8)	1047	41.0 (39.8-42.2)
Began > 5 years ago	1028	42.9 (41.7-44.2)	476	45.3 (43.5-47.2)	1504	43.7 (42.7-44.7)
Previous surgery						
No	870	37.8 (36.5-39.1)	627	42.0 (40.4-43.6)	1497	39.6 (38.5-40.6)
Yes	953	44.0 (42.7-45.3)	336	47.1 (44.9-49.3)	1289	44.8 (43.7-45.9)
Previous medication						
Topical steroid	1536	41.7 (40.7-42.7)	781	44.5 (43.0-45.9)	2317	42.7 (41.8-43.5)
Topical antihistamine	46	45.1 (40.0-50.1)	31	46.8 (39.2-54.3)	77	45.8 (41.6-49.9)
Systemic antihistamine	154	46.2 (42.9-49.5)	106	47.9 (44.1-51.7)	260	46.9 (44.4-49.3)
Systemic steroid	328	44.4 (42.1-46.6)	57	44.2 (38.6-49.8)	385	44.3 (42.3-46.4)
Long term antibiotic	122	48.0 (44.1-51.8)	182	46.9 (44.0-49.9)	304	47.4 (45.0-49.7)
Comorbidities						
No asthma	1116	38.4 (37.3-39.6)	758	43.1 (41.7-44.6)	1874	40.3 (39.4-41.2)
Asthma	704	45.0 (43.5-46.5)	203	46.3 (43.4-49.2)	907	45.3 (43.9-46.6)
No allergies	863	37.6 (36.4-38.9)	473	41.2 (39.3-43.0)	1336	38.9 (37.8-40.0)
Allergies	642	44.5 (42.8-46.1)	361	45.8 (43.8-47.9)	1003	45.0 (43.7-46.2)
Smoker?						
No	1484	40.8 (39.7-41.8)	715	43.0 (41.5-44.5)	2199	41.5 (40.6-42.3)
Yes	316	42.4 (40.1-44.6)	242	46.5 (43.8-47.9)	558	44.2 (42.4-45.9)
All patients	1836	41.0 (40.1-41.9)	967	43.7 (42.4-45.0)	2803	42.0 (41.2-42.7)

Table 9 Pre-operative SNOT-22 scores by methodological variables

Variable	N	Mean	95% CI
3-month response			
Yes	2263	42.5	41.6-43.3
No	540	39.8	38.1-41.5
12-month response			
Yes	2229	42.0	41.2-42.8
No	574	41.8	40.1-43.5
Retrospective completion of pre-op form			
Yes	235	50.2	47.4-53.0
No	2568	41.2	40.4-42.0

Table 10 Distal extent of surgery in 3128 patients

Distal extent of surgery	Polyp removal	Sinus only	All operations
	N (%)	N (%)	N (%)
Simple polypectomy	699 (34.3)	0 (0)	699 (22.3)
Antral washout	291 (14.3)	157 (14.3)	448 (14.3)
Inferior meatus	18 (0.9)	41 (3.8)	59 (1.9)
Middle meatus	170 (8.3)	173 (15.9)	343 (11.0)
Anterior ethmoids	320 (15.7)	410 (37.6)	730 (23.3)
Posterior ethmoids	312 (15.3)	187 (17.2)	499 (16.0)
Frontal sinus (not sphenoid)	76 (3.7)	68 (6.2)	144 (4.6)
Sphenoid sinus (not frontal)	88 (4.3)	37 (3.4)	125 (4.0)
Frontal and sphenoid sinuses	65 (3.2)	16 (1.5)	81 (2.6)
Total	2039 (100)	1089 (100)	3128 (100)

Table 11 Pre-operative imaging (more than one imaging technique may have been used)

	Polyp removal (N = 2039)	Sinus only N = 1089)	All operations N = 3128
	N (%)	N (%)	N (%)
None	934 (45.8)	116 (10.6)	1050 (33.6)
CT	1031 (50.6)	872 (80.1)	1903 (60.8)
MRI	7 (0.3)	14 (1.3)	21 (0.7)
X-ray	75 (3.7)	107 (9.8)	182 (5.8)

Table 12 Distal extent of surgery in patients who did not have pre-operative CT or MRI-scans

Distal extent of surgery	Polyp removal	Sinus only	All operations
	N (%)	N (%)	N (%)
Simple polypectomy	580 (57.8)	0 (0)	580 (47.8)
Antral washout	267 (26.6)	136 (64.8)	403 (33.2)
Inferior meatus	9 (0.9)	28 (13.3)	37 (3.0)
Middle meatus	68 (6.8)	29 (13.8)	97 (8.0)
Anterior ethmoids	57 (5.7)	12 (5.7)	69 (5.7)
Posterior ethmoids	12 (1.2)	3 (1.4)	15 (1.2)
Frontal sinus (not sphenoid)	4 (0.4)	1 (0.5)	5 (0.4)
Sphenoid sinus (not frontal)	3 (0.3)	1 (0.5)	4 (0.3)
Frontal and sphenoid sinuses	3 (0.3)	0 (0)	3 (0.3)
Total	1003 (100)	210 (100)	1213 (100)

Table 13 Lund-Mackay score by extent of sinus procedure

Distal extent of surgery	N	Mean	95% CI
Simple polypectomy	121	11.7	10.2-13.2
Antral washout only	43	8.8	6.4-11.2
Inferior meatus	17	5.8	2.2-9.4
Middle meatus	222	7.4	6.6-8.3
Anterior ethmoids	637	8.5	8.1-8.9
Posterior ethmoids	468	12.6	12.1-13.2
Frontal sinus (not sphenoid)	138	11.3	10.3-12.2
Sphenoid sinus (not frontal)	117	14.7	13.6-15.8
Frontal and sphenoid sinuses	77	17.3	16.0-18.6
Total*	1840	10.6	10.3-10.9

* No score available for 1288 patients

Table 14 Pre-operative SNOT-22 score by extent of sinus surgery

Distal extent of surgery	N	Mean	95% CI
Simple polypectomy	634	38.3	36.8-39.9
Antral washout only	392	40.6	38.7-42.6
Inferior meatus	47	46.3	40.0-52.5
Middle meatus	311	40.8	38.7-43.0
Anterior ethmoids	655	44.5	42.9-46.1
Posterior ethmoids	446	43.0	41.2-44.8
Frontal sinus (not sphenoid)	128	43.7	40.1-47.3
Sphenoid sinus (not frontal)	116	45.6	41.7-49.5
Frontal and sphenoid sinuses	74	44.3	39.6-49.1
Total	2803	42.0	41.2-42.7

Table 15 Illumination* and removal techniques used

Removal instruments used	Polyp removal		Sinus only		All operations	
	Headlamp	Endoscope	Headlamp	Endoscope	Headlamp	Endoscope
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
**Debrider	22 (2.9)	407 (31.5)	4 (1.7)	82 (9.6)	26 (2.6)	489 (22.8)
Non-debrider	689 (92.2)	734 (56.8)	120 (50.8)	608 (71.3)	809 (82.3)	1342 (62.6)
None specified	36 (4.8)	151 (11.7)	112 (47.5)	163 (19.1)	148 (15.1)	314 (14.6)
Total	747 (100)	1292 (100)	236 (100)	853 (100)	983 (100)	2145 (100)

* Endoscope category includes 12 patients where a microscope was used
** Debrider may have been used alone or in combination with other instruments

Table 16 Distal extent of surgery by illumination technique.

Distal extent of surgery	Polyp removal		Sinus only		All operations	
	Headlamp	Endoscope	Headlamp	Endoscope	Headlamp	Endoscope
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Simple polyp.	386 (51.7)	313 (24.2)	0 (0)	0 (0)	386 (39.3)	313 (14.6)
Ant. washout	230 (30.8)	61 (4.7)	140 (58.9)	17 (2.0)	370 (37.6)	78 (3.6)
Inf. meatus	12 (1.6)	6 (0.5)	36 (15.2)	5 (0.6)	48 (4.9)	11 (0.5)
Mid meat/unc	39 (5.2)	131 (10.1)	35 (14.8)	138 (16.2)	74 (7.5)	269 (12.5)
Ant. ethmoid	49 (6.6)	271 (21.0)	14 (5.9)	396 (46.4)	63 (6.4)	667 (31.1)
Post. ethmoid	14 (1.9)	298 (23.1)	3 (1.3)	184 (21.6)	17 (1.7)	482 (22.5)
*Frontal	13 (1.7)	63 (4.9)	8 (3.4)	60 (7.0)	21 (2.1)	123 (5.7)
**Sphenoid	2 (0.3)	86 (6.7)	0 (0)	37 (4.3)	2 (0.2)	123 (5.7)
***Front/sphen	2 (0.3)	63 (4.9)	0 (0)	16 (1.9)	2 (0.2)	79 (3.7)
Total	747 (100)	1292 (100)	236 (100)	853 (100)	983 (100)	2145 (100)

* Frontal but not sphenoid
** Sphenoid but not frontal
*** Frontal and sphenoids

Table 17 Pre-operative SNOT-22 score for illumination and removal techniques used

	Polyp removal (N = 1836)		Sinus only (N = 967)		All operations (N = 2803)	
	N	Mean (95% CI)	N	Mean (95% CI)	N	Mean (95% CI)
Illumination						
Endoscope	1165	42.2 (41.0-43.4)	762	44.0 (42.6-45.5)	1927	42.9 (42.0-43.8)
Headlamp	671	39.0 (37.5-40.4)	205	42.6 (39.7-45.5)	876	39.8 (38.5-41.1)
Removal instruments						
Debrider	382	42.2 (40.1-44.3)	65	42.2 (37.7-46.7)	447	42.2 (40.3-44.1)
Non-debrider	1277	40.7 (39.6-41.8)	663	44.9 (43.3-46.6)	1940	42.2 (41.3-43.1)
None specified	177	40.6 (37.7-43.5)	239	40.8 (38.2-43.3)	416	40.7 (38.8-42.6)
All patients	1836	41.0 (40.1-41.9)	967	43.7 (42.4-45.0)	2803	42.0 (41.2-42.7)

Table 18 Hospital stay and packing used

	Polyp removal	Sinus only	All operations
	N (%)	N (%)	N (%)
Hospital stay			
Day cases	234 (15.2)	129 (16.4)	363 (15.6)
Mean length of stay for in-patients (range)	1.2 days (1-8)	1.2 days (1-7)	1.2 (1-8)
Packing used			
No packing used	399 (19.6)	389 (35.7)	788 (25.7)
Glove finger	123 (6.0)	35 (3.2)	158 (5.15)
Gauze	648 (31.8)	268 (24.6)	916 (29.9)
Kaltostat or similar	134 (6.6)	62 (5.7)	196 (6.4)
Tampon	733 (35.9)	305 (28.0)	1038 (33.8)
Planned packing removal time			
No packing used	388 (19.4)	386 (36.3)	774 (25.3)
As soon as bleeding stops	15 (0.7)	6 (0.6)	21 (0.7)
In recovery	108 (5.4)	42 (3.9)	21 (4.9)
Later on day of operation	277 (13.9)	111 (10.4)	388 (12.7)
Day following operation (in ward)	1175 (58.8)	470 (44.2)	1645 (53.7)
Other time planned	34 (1.7)	48 (4.5)	82 (2.7)

Table 19 Pre-operative SNOT-22 score by hospital stay

	Polyp removal (N = 1836)		Sinus only (N = 967)		All operations (N = 2803)	
	N	Mean (95% CI)	N	Mean (95% CI)	N	Mean (95% CI)
Hospital stay						
Day cases	232	39.5 (36.9-42.0)	127	42.6 (39.2-46.0)	359	40.6 (38.5-42.6)
In-patients	1284	41.7 (40.6-42.8)	655	44.9 (43.3-46.5)	1939	42.8 (41.9-43.7)
All patients	1836	41.0 (40.1-41.9)	967	43.7 (42.4-45.0)	2803	42.0 (41.2-42.7)

Table 20 Unadjusted day case rates by participating Trust and hospital

Trust ID	% of operations performed as day case
t901	1.4%
t902	12.5%
t903	0.0%
t904	10.3%
t905	6.7%
t906	14.3%
t907	4.8%
t908	9.7%
t909	0.0%
t910	4.0%
t911	86.7%
t912	15.4%
t913	3.8%
t914	0.0%
t915	10.3%
t916	0.0%
t918	6.9%
t919	15.6%
t920	5.6%
t921	50.0%
t922	0.0%
t923	35.7%
t924	5.3%
t926	23.1%
t927	4.0%
t928	52.7%
t929	80.0%
t930	3.7%
t931	16.7%
t932	40.0%
*h9331	7.1%
*h9332	8.8%
t934	8.8%
t935	5.9%
t936	0.0%
t937	5.4%
t938	5.6%
t939	11.1%
t940	20.0%
t941	2.0%
t942	3.8%
*h9431	6.1%
*h9432	0.0%
t944	5.2%
t945	16.7%
t946	26.3%
t947	0.0%
t948	15.4%
t949	5.9%
t950	25.6%
t951	16.7%
t952	18.6%
t953	38.5%
t954	100.0%
t955	0.0%
t956	4.8%
t957	0.0%
t958	9.1%
t959	0.0%

t960	0.0%
t961	3.3%
t962	19.0%
t963	70.8%
t964	0.0%
t965	2.9%
t966	8.3%
t967	8.8%
t968	18.2%
t969	18.2%
t970	3.2%
t971	5.0%
t972	20.0%
t973	0.0%
t974	21.4%
t975	11.1%
t976	4.5%
t977	22.7%
t978	0.0%
t979	52.0%
*h9801	4.3%
*h9802	0.0%
*h9811	90.9%
*h9812	100.0%
*h9821	100.0%
*h9822	100.0%
*h9823	20.8%
*h9824	100.0%
National	15.6%

*Codes beginning with 'h' indicate hospital level data. This is provided when a Trust had more than one participating hospital. Codes beginning with 't' indicate Trust level data where only one hospital provided data within a Trust.

Table 21 Surgical grades

	Polyp removal	Sinus only	All operations
	N (%)	N (%)	N (%)
Grade of main operator			
Consultant	868 (42.8)	560 (51.5)	1428 (45.8)
Associate specialist	167 (8.2)	107 (9.8)	274 (8.8)
Staff grade	288 (14.2)	116 (10.7)	404 (13.0)
Registrar	627 (30.9)	277 (25.5)	904 (29.0)
BST (SHO)	80 (3.9)	27 (2.5)	107 (3.4)
Senior grade in theatre			
Consultant	1240 (62.6)	766 (72.0)	2006 (65.9)
Associate specialist	142 (7.2)	95 (8.9)	237 (7.8)
Staff grade	220 (11.1)	83 (7.8)	303 (9.9)
Registrar	373 (18.8)	117 (11.0)	490 (16.1)
BST (SHO)	7 (0.3)	3 (0.3)	10 (0.3)

Table 22 Pre-operative SNOT-22 score by grade of operating surgeon

	Polyp removal (N = 1836)		Sinus only (N = 967)		All operations (N = 2803)	
	N	Mean (95% CI)	N	Mean (95% CI)	N	Mean (95% CI)
Grade						
Consultant	774	42.2 (40.8-43.6)	493	44.1 (42.2-46.0)	1267	42.9 (41.8-44.1)
Associate specialist	143	38.9 (35.8-41.9)	95	43.6 (39.5-47.6)	238	40.7 (38.3-43.2)
Staff grade	267	39.8 (37.3-42.3)	106	40.4 (36.6-44.1)	373	40.0 (37.9-42.0)
Registrar	570	40.7 (39.1-42.4)	249	44.1 (41.6-46.7)	819	41.8 (40.4-43.2)
BST (SHO)	75	40.1 (35.4-44.8)	22	48.0 (40.2-55.9)	97	41.9 (37.9-46.0)
All patients	1836	41.0 (40.1-41.9)	967	43.7 (42.4-45.0)	2803	42.0 (41.2-42.7)

Table 23 Lund-Mackay score by grade of operating surgeon

	Polyp removal (N = 1836)		Sinus only (N = 967)		All operations (N = 2803)	
	N	Mean (95% CI)	N	Mean (95% CI)	N	Mean (95% CI)
Grade						
Consultant	564	14.2 (13.7-14.7)	472	7.4 (6.9-7.8)	1036	11.1 (10.7-11.5)
Associate specialist	55	10.9 (9.4-12.4)	62	7.3 (6.4-8.3)	117	9.0 (8.1-9.9)
Staff grade	73	12.6 (11.2-14.1)	57	5.8 (4.8-6.8)	130	9.6 (8.5-10.7)
Registrar	279	13.6 (12.9-14.4)	245	6.7 (6.1-7.3)	524	10.4 (9.8-10.9)
BST (SHO)	19	8.5 (4.9-12.1)	11	4.2 (1.4-6.9)	30	6.9 (4.4-9.4)
All patients	992	13.6 (13.2-14.0)	848	7.0 (6.7-7.3)	1840	10.6 (10.3-10.9)

Table 24 Other perioperative variables

	Polyp removal	Sinus only	All operations
	N (%)	N (%)	N (%)
Mean duration of operation in minutes (range)	38.5 (3-180)	41.5 (2-180)	39.6 (2-180)
Anaesthetic			
Local only	71 (3.6)	22 (2.1)	93 (3.1)
General only	562 (28.2)	215 (20.3)	777 (25.4)
General plus local	1362 (68.3)	823 (77.6)	2185 (71.5)
Approach			
Intranasal	1987 (99.1)	1046 (99.0)	3033 (99.1)
Sublabial	5 (0.2)	9 (0.9)	14 (0.5)
External	13 (0.6)	12 (1.1)	25 (0.8)
Transantral	15 (0.7)	6 (0.6)	21 (0.7)
Diathermy used	94 (4.6)	116 (10.6)	210 (6.7)
Preparations during operation			
None used	142 (7.0)	48 (4.4)	190 (6.1)
Cocaine	1301 (63.8)	699 (64.2)	2000 (65.1)
Infiltration of vasoconstrictors	491 (24.1)	463 (42.5)	954 (31.1)
Topical vasoconstrictors	1081 (53.0)	601 (55.2)	1682 (54.8)

Table 25 SNOT-22 scores at different time points in the audit

	Polyp removal			Sinus only			All operations		
	N	Mean	95% CI	N	Mean	95% CI	N	Mean	95% CI
Pre-op	1836	41.0	40.1-41.9	967	43.7	42.4-45.0	2803	42.0	41.2-42.7
3-months	1507	22.9	21.9-23.9	777	30.6	29.0-32.2	2284	25.5	24.7-26.4
12-months	1510	25.5	24.4-26.6	746	32.2	30.5-33.9	2256	27.7	26.8-28.6

Table 26 Patient ratings of symptom change at 3 and 12-months

	Polyp removal		Sinus only		All operations	
	N	%	N	%	N	%
3-months						
Much better	1068	70.8	362	46.0	1430	62.3
A little better	278	18.4	235	29.9	513	22.3
About the same	140	9.3	126	16.0	266	11.6
A little worse	13	0.9	40	5.1	53	2.3
Much worse	9	0.6	24	3.1	33	1.4
12-months						
Much better	960	63.2	325	43.4	1285	56.7
A little better	283	18.6	185	24.7	468	20.6
About the same	192	12.6	158	21.1	350	15.4
A little worse	46	3.0	48	6.4	94	4.2
Much worse	37	2.4	33	4.4	70	3.1

Table 27 Patient ratings of overall operation results at 3 and 12-months

	Polyp removal		Sinus only		All operations	
	N	%	N	%	N	%
3-months						
Excellent	420	32.5	114	16.6	534	27.1
Very good	454	30.1	160	23.0	614	27.7
Good	262	19.7	163	25.9	425	21.8
Fair	219	12.1	164	20.5	383	15.0
Poor	157	5.7	144	14.0	301	8.5
12-months						
Excellent	420	27.8	114	15.3	534	23.7
Very good	454	30.0	160	21.5	614	27.2
Good	262	17.3	163	21.9	425	18.8
Fair	219	14.5	164	22.0	383	17.0
Poor	157	10.4	144	19.3	301	13.3

Table 28 Patient ratings of pain during and after their operation

	Polyp removal		Sinus only		All operations	
	N	%	N	%	N	%
Pain during the operation						
None	1112	73.5	526	68.3	1638	71.8
Mild	222	14.7	104	13.5	326	14.3
Moderate	143	9.5	100	13.0	243	10.6
Severe	35	2.3	40	5.2	75	3.3
Pain in the first 24 hours post-op						
None	437	28.6	136	17.3	573	24.8
Mild	623	40.8	260	33.1	883	38.2
Moderate	371	24.3	275	35.0	646	27.9
Severe	95	6.2	114	14.5	209	9.0
Pain in the first week post-op						
None	693	45.3	193	24.6	886	38.3
Mild	618	40.4	297	37.9	915	39.6
Moderate	182	11.9	223	28.4	405	17.5
Severe	35	2.3	71	9.1	106	4.6

Table 29 Clinician and patient reports of adverse events

	Polyp removal		Sinus only		All operations	
	N	%	N	%	N	%
Clinician reported adverse events						
No adverse events reported	1867	91.6	1054	96.8	2921	93.4
Excessive bleeding during the operation	133	6.5	24	2.2	157	5.0
Excessive bleeding after the operation	20	1.0	6	0.5	26	0.8
Conversion to unplanned procedure	4	0.2	0	0	4	0.1
Orbital complications	4	0.2	3	0.3	7	0.2
Intra-cranial complications	2	0.1	0	0	2	0.1
Return to theatre	2	0.1	0	0	2	0.1
Other	21	1.0	4	0.4	25	0.8
Patient reported adverse events						
Bleeding problems after discharge	570	37.5	337	49.2	957	41.4
Return to hospital for bleeding problems	30	2.0	48	6.1	78	3.4
Any sino-nasal re-admission (up to 3-months)	55	3.6	32	4.1	87	3.8

Table 30 Contact with GP for sino-nasal problems

	Polyp removal		Sinus only		All operations	
	N	%	N	%	N	%
First 3-months after surgery						
None	1139	75.0	451	57.6	1590	69.1
Once	240	15.8	160	20.4	400	17.4
Twice	80	5.3	95	12.1	175	7.6
Three times	29	1.9	40	5.1	69	3.0
More than three times	31	2.0	37	4.7	68	2.9
3-12 months after surgery						
None	1072	70.7	416	55.5	1488	65.7
Once	170	11.2	101	13.5	271	12.0
Twice	121	8.0	92	12.3	213	9.4
Three times	56	3.7	54	7.2	110	4.9
More than three times	97	6.4	87	11.6	184	8.1

Table 31 Post-operative medication use

	Polyp removal		Sinus only		All operations	
	N	%	N	%	N	%
Any steroid medication in the first 3-months	1026	68.9	443	57.3	1469	65.0
Oral or injected steroids in the first 3-months	272	17.6	103	13.0	375	16.1
Any medication for sino-nasal problems						
At 3-months	846	55.8	356	45.8	1202	52.4
At 12-months	833	54.8	343	45.9	1176	51.9

Table 32 Case-mix variables eliminated from final model

Variable	P-value at elimination 3-month model	P-value at elimination: 12-month model
Clinician-rated Lund-Mackay score	0.86	0.91
Was Lund-Mackay score performed?	0.62	0.42
Previous treatment with systemic antihistamines	0.99	0.61
Patient-reported allergies	0.73	0.31
Patient-reported smoking behaviour	0.98	0.95
Clinician reported otitis media	0.67	0.72

Table 33 Final case mix model with 3 and 12-month SNOT-22 scores

Variable	Coefficient		p value		95% C.I. (robust s.e.)	
	3-mth	12-mth	3-mth	12-mth	3-mth	12-mth
Pre-op SNOT-22	0.49	0.59	< 0.01	< 0.01	0.45, 0.53	0.54, 0.63
Age (years)	-0.03	-0.04	0.31	0.20	-0.09, 0.03	-0.10, 0.02
Male gender	-1.45	-0.58	0.09	0.50	-3.15, 0.25	-2.28, 1.11
Patient-reported asthma	1.37	2.60	0.13	< 0.01	-0.41, 3.15	0.80, 4.41
Clinician-reported aspirin sensitivity	4.10	3.21	0.06	0.15	-0.22, 8.43	-1.21, 7.63
Clinician reported lower RTI	-1.26	-10.24	0.75	< 0.01	-9.00, 6.47	-16.37, -4.12
Symptoms present for < 1 year	-3.17	-2.36	0.02	0.09	-5.75, -0.58	-5.09, 0.37
Previous sino-nasal surgery	4.24	3.75	< 0.01	< 0.01	2.79, 5.69	2.12, 5.39
Polyp grade compared to no polyps						
I/0	-4.36	-3.79	0.01	0.02	-7.69, -1.03	-7.04, -0.54
I/I	-3.02	-2.76	0.02	0.05	-5.59, -0.45	-5.46, -0.05
II/0	-5.91	-3.92	< 0.01	0.04	-9.76, -2.06	-7.75, -0.09
II/I	-5.69	-6.54	< 0.01	< 0.01	-9.91, -1.48	-10.04, -3.04
II/II	-7.18	-4.62	< 0.01	< 0.01	-9.49, -4.86	-7.11, -2.13
III/0	-8.66	-8.70	< 0.01	< 0.01	-13.04, -4.29	-13.55, -3.85
III/I	-12.28	-8.90	< 0.01	< 0.01	-18.01, -6.55	-14.55, -3.24
III/II	-8.86	-10.93	< 0.01	< 0.01	-11.85, -5.87	-14.48, -7.39
III/III	-12.05	-10.91	< 0.01	< 0.01	-14.77, -9.32	-14.00, -7.82
No data on polyp extent	-7.44	-7.79	< 0.01	< 0.01	-13.01, -1.87	-13.50, -2.09
Prev. treatment: topical steroids	0.94	2.27	0.37	0.04	-1.13, 3.02	0.09, 4.45
Prev. treatment: topical antihistamines	3.53	1.69	0.16	0.46	-1.44, 8.50	-2.78, 6.15
Prev. treatment: systemic steroids	-1.93	3.26	0.09	0.02	-4.06, 0.21	0.55, 5.97
Prev. treatment long-term antibiotics	2.45	1.65	0.06	0.21	-0.12, 5.02	-0.91, 4.21
ASA data compared to ASA grade 1						
ASA grade 2	1.33	-0.07	0.12	0.95	-0.36, 3.01	-2.05, 1.92
ASA grade 3-4	6.66	3.74	< 0.01	0.12	2.57, 10.74	-0.93, 8.40
No data on ASA grade	3.96	0.17	0.01	0.92	0.83, 7.10	-3.09, 3.42
Sinus infection at surgery versus none						
Infection	-1.00	-1.36	0.26	0.17	-2.75, 0.75	-3.31, 0.58
No data on infection	-1.99	-2.25	0.09	0.07	-4.32, 0.35	-4.64, 0.15
Carstairs deprivation index	0.17	0.37	0.19	0.01	-0.09, 0.44	0.09, 0.66
Date of 3-month form completion	0.09	0.30	0.15	0.09	-0.03, 0.21	-0.05, 0.64
Retrospective pre-op assessment	-5.88	-6.41	< 0.01	< 0.01	-8.51, -3.25	-8.88, -3.94
Constant	7.35	-10.3				

Table 34 SNOT-22 scores at 3-months by participating Trusts and hospitals

Unit ID*	N	Mean observed SNOT-22 score	Mean expected SNOT-22 score	O-E difference	95% confidence interval	
t901	67	23.81	23.61	0.20	-3.87	4.28
t902	25	19.56	22.71	-3.15	-9.82	3.52
t903	23	29.10	24.88	4.22	-2.74	11.17
t904	26	29.35	24.38	4.97	-1.58	11.51
t905	15	31.18	32.84	-1.66	-10.27	6.95
t907	20	21.05	18.41	2.64	-4.82	10.09
t908	29	25.17	25.03	0.14	-6.06	6.33
t909	17	26.29	24.35	1.93	-6.16	10.02
t910	24	31.65	26.78	4.87	-1.93	11.68
t911	15	26.23	22.23	4.00	-4.61	12.62
t912	24	21.47	21.74	-0.27	-7.08	6.54
t913	25	21.31	27.72	-6.41	-13.08	0.26
t914	11	27.24	25.71	1.53	-8.53	11.59
t915	28	25.14	28.55	-3.41	-9.71	2.90
***t916	18	14.62	23.80	-9.18	-17.04	-1.32
t918	28	28.32	24.70	3.61	-2.69	9.92
t919	32	30.25	25.29	4.96	-0.93	10.86
t920	18	32.66	28.96	3.71	-4.16	11.57
t921	58	25.75	22.50	3.24	-1.14	7.62
t922	23	31.49	27.39	4.10	-2.85	11.06
t923	38	26.48	27.20	-0.72	-6.14	4.69
t924	17	23.09	28.27	-5.18	-13.27	2.91
t926	13	31.20	24.62	6.58	-2.67	15.83
t927	23	34.94	30.73	4.21	-2.75	11.16
t928	70	25.53	24.08	1.46	-2.53	5.44
t929	20	24.54	25.48	-0.94	-8.40	6.52
t930	25	18.20	24.26	-6.06	-12.73	0.61
h9331	54	26.24	26.89	-0.65	-5.19	3.89
h9332	34	23.97	26.64	-2.67	-8.39	3.05
t934	33	22.38	24.97	-2.58	-8.39	3.23
t935	17	22.54	23.62	-1.08	-9.17	7.01
t937	52	19.87	22.16	-2.29	-6.91	2.34
t938	35	22.34	21.73	0.61	-5.03	6.25
t940	10	17.20	17.35	-0.15	-10.70	10.40
t941	49	22.46	24.23	-1.77	-6.53	3.00
t942	26	24.40	26.65	-2.25	-8.80	4.29
h9431	46	25.26	24.71	0.55	-4.37	5.47
t944	57	28.38	31.24	-2.86	-7.28	1.56
t945	59	21.55	23.38	-1.83	-6.17	2.51
t946	19	25.08	25.97	-0.89	-8.54	6.76
t947	15	25.27	26.85	-1.59	-10.20	7.02
t948	27	26.09	25.38	0.71	-5.71	7.13
t949	18	26.17	30.66	-4.49	-12.35	3.37
t950	40	24.58	21.49	3.10	-2.18	8.37
t951	12	29.57	24.64	4.92	-4.71	14.55
t952	43	24.18	27.37	-3.19	-8.28	1.90
t953	26	23.34	21.08	2.27	-4.27	8.81
t956	57	24.85	26.60	-1.75	-6.17	2.66
t958	31	19.83	24.20	-4.37	-10.36	1.62
t959	21	28.64	28.49	0.15	-7.13	7.43
t960	29	30.38	29.14	1.24	-4.96	7.43
t961	29	24.70	26.35	-1.66	-7.85	4.54
t962	21	30.44	27.05	3.38	-3.90	10.66
t963	24	18.82	19.98	-1.15	-7.96	5.65
t964	10	27.40	29.05	-1.65	-12.20	8.89
***t965	64	21.72	26.34	-4.62	-8.79	-0.45
t966	34	29.03	25.43	3.61	-2.11	9.33
t967	55	27.16	25.00	2.15	-2.34	6.65
t968	21	33.30	26.63	6.67	-0.61	13.95
t969	10	14.67	18.67	-4.00	-14.55	6.55

t970	29	26.74	26.37	0.38	-5.82	6.57
t971	20	18.84	22.97	-4.13	-11.59	3.33
t972	14	24.76	23.93	0.82	-8.09	9.74
t973	11	28.00	24.73	3.27	-6.79	13.33
t974	14	30.23	29.64	0.58	-8.33	9.50
t975	18	21.24	20.70	0.54	-7.33	8.40
t976	22	21.50	21.36	0.14	-6.98	7.25
t977	41	27.34	23.68	3.66	-1.55	8.87
t978	19	29.86	30.76	-0.90	-8.55	6.75
t979	25	24.57	22.19	2.38	-4.29	9.05
h9801	84	28.99	30.05	-1.06	-4.70	2.58
h9811	11	36.00	29.72	6.28	-3.78	16.33
h9812	22	21.87	22.86	-0.99	-8.10	6.13
h9823	23	32.05	29.58	2.46	-4.49	9.42

*Codes beginning with 'h' indicate hospital level data. This is provided when a Trust had more than one participating hospital. Codes beginning with 't' indicate Trust level data where only one hospital provided data within a Trust.
** This table displays only the 74 Trusts and hospitals for whom full risk-adjusted outcomes data for more than 10 patients was available at 3-months.
***Trusts with patients whose observed SNOT-22 scores were significantly better ($p < 0.05$) than expected at 3-months.

Table 35 SNOT-22 scores at 3-months by participating Consultants

Cons. ID	N	Mean observed SNOT-22 score	Mean expected SNOT-22 score	O-E difference	95% confidence interval	
c901102	30	23.46	23.05	0.41	-5.70	6.52
c901105	24	23.81	23.44	0.37	-6.46	7.20
c901106	13	24.62	25.20	-0.59	-9.87	8.70
c902106	19	18.21	24.00	-5.79	-13.47	1.89
c903101	16	28.01	25.18	2.84	-5.53	11.21
c905104	14	29.05	31.87	-2.81	-11.76	6.13
c908105	10	36.00	34.34	1.65	-8.93	12.24
c909103	11	26.08	23.00	3.08	-7.01	13.18
c910103	17	35.71	27.97	7.74	-0.38	15.86
c912103	15	20.79	24.20	-3.42	-12.06	5.23
c913106	10	27.00	32.83	-5.83	-16.42	4.76
c914101	11	27.24	25.71	1.53	-8.57	11.62
c916101	11	18.18	21.37	-3.19	-13.29	6.90
c919101	12	27.83	25.12	2.71	-6.95	12.37
c919104	20	31.70	25.39	6.31	-1.17	13.80
c921107	44	25.07	22.07	3.00	-2.04	8.05
c922107	15	27.05	27.92	-0.87	-9.51	7.78
c923108	26	28.24	27.77	0.47	-6.10	7.03
c927104	12	29.21	26.04	3.17	-6.49	12.84
c927105	11	41.18	35.85	5.33	-4.76	15.43
c928105	15	23.80	27.47	-3.67	-12.32	4.97
c928108	28	24.50	21.42	3.08	-3.25	9.41
c928110	17	28.40	26.11	2.30	-5.82	10.41
c930102	16	16.38	22.50	-6.12	-14.49	2.25
c933101	11	25.53	23.91	1.62	-8.47	11.71
c933108	17	28.46	30.20	-1.74	-9.86	6.38
**c933202	21	22.01	29.54	-7.53	-14.84	-0.23
c933203	13	27.15	21.96	5.19	-4.09	14.47
c934108	29	24.36	26.36	-2.00	-8.22	4.22
c935104	10	15.62	19.71	-4.09	-14.67	6.50
c937103	10	14.90	19.17	-4.27	-14.85	6.32
c937106	13	18.54	19.45	-0.91	-10.20	8.37
c937107	29	22.18	24.40	-2.22	-8.44	3.99
c938105	13	29.98	23.76	6.22	-3.07	15.50
c941108	20	23.84	25.32	-1.48	-8.96	6.01
c941111	10	26.87	24.72	2.15	-8.43	12.74
c942101	13	26.90	27.84	-0.94	-10.22	8.35
c942105	13	21.89	25.46	-3.57	-12.86	5.71
c943101	22	21.56	24.30	-2.74	-9.87	4.40
c943109	20	28.28	24.36	3.92	-3.57	11.40
c944101	38	29.70	32.53	-2.82	-8.26	2.61
c944104	13	27.38	28.35	-0.96	-10.25	8.32
c945105	15	19.31	24.76	-5.45	-14.09	3.19
c945107	15	14.47	19.26	-4.79	-13.44	3.85
c945110	13	34.00	26.72	7.28	-2.01	16.56
c945112	10	19.40	27.65	-8.25	-18.83	2.34
c948104	23	24.63	25.02	-0.40	-7.38	6.58
c949104	12	29.34	31.05	-1.71	-11.37	7.96
c950108	13	26.53	22.96	3.56	-5.72	12.85
c950110	17	24.55	21.31	3.24	-4.88	11.36
c952104	11	30.21	25.28	4.93	-5.16	15.02
c952108	18	23.26	28.87	-5.62	-13.51	2.27
c952112	14	20.64	27.09	-6.45	-15.40	2.50
c953106	15	21.07	19.81	1.26	-7.39	9.90
c956103	19	22.26	22.46	-0.20	-7.88	7.48
c956104	14	27.13	29.20	-2.07	-11.02	6.88
c956106	14	26.11	28.88	-2.77	-11.72	6.18
c956108	10	24.80	27.65	-2.85	-13.43	7.74
c958101	16	18.94	23.18	-4.24	-12.61	4.13
c958105	14	21.11	25.20	-4.09	-13.03	4.86

c959107	19	26.61	27.71	-1.10	-8.78	6.58
c960106	11	26.55	30.49	-3.95	-14.04	6.14
c961107	20	20.46	25.16	-4.70	-12.18	2.79
c963105	13	23.43	21.16	2.27	-7.02	11.55
c965102	14	21.50	25.57	-4.07	-13.01	4.88
c965104	12	27.58	30.75	-3.16	-12.83	6.50
c965113	13	24.54	23.20	1.34	-7.95	10.62
c966110	15	21.03	24.61	-3.57	-12.22	5.07
c967101	15	21.00	22.97	-1.97	-10.61	6.68
c967104	24	27.78	26.19	1.60	-5.24	8.43
c967106	13	31.83	25.82	6.01	-3.27	15.30
c970101	17	23.51	25.06	-1.54	-9.66	6.58
c970102	12	31.32	28.22	3.10	-6.56	12.76
c971105	13	24.49	22.89	1.60	-7.69	10.88
c975102	10	25.03	20.75	4.28	-6.31	14.86
c976101	10	15.00	18.43	-3.43	-14.01	7.16
***c977108	11	37.91	24.55	13.36	3.26	23.45
c978104	13	20.90	27.66	-6.76	-16.05	2.52
c979102	19	22.75	20.09	2.66	-5.02	10.34
c980105	12	35.13	33.05	2.08	-7.58	11.75
c980117	42	30.19	30.93	-0.75	-5.91	4.42
c980118	16	21.65	27.17	-5.52	-13.89	2.85
c981103	11	36.00	29.72	6.28	-3.82	16.37
c981202	22	21.87	22.86	-0.99	-8.12	6.15
c982308	14	35.91	31.37	4.55	-4.40	13.50

*This table displays only the 85 Consultants for whom full risk-adjusted outcomes data for more than 10 patients was available at 3-months.
**Consultant with patients whose observed SNOT-22 scores were significantly better ($p < 0.05$) than expected at 3-months.
***Consultant with patients whose observed SNOT-22 scores were significantly worse ($p < 0.05$) than expected at 3-months.

Table 36 SNOT-22 scores at 12-months by participating Trusts and hospitals

Unit ID*	N	Mean observed SNOT-22 score	Mean expected SNOT-22 score	O-E difference	95% confidence interval	
t901	63	24.63	24.63	0.00	-4.42	4.42
t902	26	21.06	26.63	-5.58	-12.46	1.31
t903	20	29.31	26.95	2.36	-5.49	10.21
t904	30	29.92	24.96	4.96	-1.45	11.37
t905	13	35.51	37.13	-1.61	-11.35	8.12
t907	17	26.24	23.18	3.06	-5.46	11.57
t908	28	28.71	29.55	-0.84	-7.48	5.79
t909	17	33.93	29.54	4.40	-4.12	12.91
***t910	25	41.48	29.05	12.43	5.41	19.45
t911	19	25.66	23.91	1.76	-6.30	9.81
t912	26	20.36	24.74	-4.38	-11.27	2.50
t913	23	27.57	29.37	-1.81	-9.13	5.52
t914	11	23.43	26.43	-3.00	-13.58	7.59
t915	27	34.56	32.10	2.45	-4.31	9.21
t916	16	21.94	25.15	-3.21	-11.99	5.57
t918	30	24.14	26.87	-2.73	-9.14	3.68
t919	32	26.77	26.04	0.74	-5.47	6.95
t920	17	32.28	29.52	2.76	-5.76	11.27
t921	63	27.33	25.36	1.97	-2.45	6.39
t922	22	29.64	31.49	-1.85	-9.33	5.64
t923	36	29.11	31.84	-2.73	-8.58	3.12
t924	16	45.59	36.96	8.63	-0.15	17.41
t926	11	29.22	27.24	1.97	-8.62	12.56
t927	21	31.39	34.26	-2.87	-10.53	4.80
t928	65	28.58	25.20	3.38	-0.98	7.73
t929	20	23.46	27.82	-4.36	-12.21	3.49
****t930	26	19.50	26.90	-7.40	-14.29	-0.52
h9331	74	26.36	24.57	1.79	-2.30	5.87
h9332	31	26.90	27.90	-1.00	-7.30	5.31
t934	32	26.44	29.66	-3.22	-9.42	2.99
t935	16	32.38	26.22	6.16	-2.62	14.94
t937	61	21.64	24.24	-2.60	-7.09	1.90
t938	34	22.37	24.07	-1.69	-7.72	4.33
t939	10	34.32	33.21	1.11	-10.00	12.21
t941	45	25.64	26.03	-0.39	-5.62	4.85
t942	24	24.73	28.75	-4.01	-11.18	3.15
h9431	48	28.82	25.58	3.24	-1.83	8.31
t944	58	32.29	33.97	-1.69	-6.30	2.92
t945	62	28.76	25.79	2.97	-1.49	7.43
t946	19	23.94	28.95	-5.01	-13.07	3.05
t947	18	26.66	31.02	-4.36	-12.64	3.91
t948	23	20.00	25.63	-5.63	-12.96	1.69
t949	19	27.43	30.30	-2.86	-10.92	5.19
t950	38	22.29	21.61	0.68	-5.02	6.38
t951	12	39.71	32.81	6.90	-3.24	17.04
t952	42	24.49	28.36	-3.87	-9.29	1.55
t953	23	28.56	25.35	3.22	-4.11	10.54
t956	57	27.63	27.53	0.10	-4.55	4.76
t958	31	20.65	26.87	-6.22	-12.53	0.08
t959	21	31.90	31.38	0.53	-7.14	8.19
t960	28	35.56	30.51	5.05	-1.59	11.69
t961	25	28.39	30.37	-1.98	-9.01	5.04
t962	19	29.80	29.11	0.69	-7.36	8.75
t963	23	20.15	19.74	0.41	-6.91	7.73
t965	57	25.52	29.22	-3.70	-8.35	0.95
t966	39	27.51	26.87	0.65	-4.97	6.27
t967	53	26.22	25.68	0.55	-4.28	5.37
t968	20	27.08	27.82	-0.74	-8.59	7.11
t970	25	28.80	28.47	0.33	-6.69	7.35
t971	20	24.43	26.98	-2.55	-10.40	5.31

t972	17	30.96	26.90	4.05	-4.46	12.57
t973	11	32.45	30.67	1.78	-8.81	12.37
t974	11	41.08	34.72	6.36	-4.23	16.95
t975	15	21.47	20.89	0.57	-8.49	9.64
t976	21	20.99	23.27	-2.27	-9.94	5.39
t977	43	24.93	25.66	-0.73	-6.09	4.62
t978	18	37.78	35.86	1.92	-6.35	10.20
t979	22	21.59	22.29	-0.70	-8.19	6.78
h9801	84	34.90	34.40	0.50	-3.33	4.33
h9802	11	26.96	30.35	-3.40	-13.98	7.19
h9811	10	33.23	30.79	2.44	-8.67	13.54
h9812	23	30.69	25.29	5.39	-1.93	12.71
h9823	19	34.14	32.78	1.36	-6.70	9.42

*Codes beginning with 'h' indicate hospital level data. This is provided when a Trust had more than one participating hospital. Codes beginning with 't' indicate Trust level data where only one hospital provided data within a Trust.
** This table displays only the 73 Trusts and hospitals for whom full risk-adjusted outcomes data for more than 10 patients was available at 12-months.
***Trust with patients whose observed SNOT-22 scores were significantly worse ($p < 0.05$) than expected at 12-months.
****Trust with patients whose observed SNOT-22 scores were significantly better ($p < 0.05$) than expected at 12-months.

Table 37 SNOT-22 scores at 12-months by participating Consultants

Cons. ID	N	Mean observed SNOT-22 score	Mean expected SNOT-22 score	O-E difference	95% confidence interval	
c901102	30	20.41	23.68	-3.27	-9.64	3.10
c901105	24	25.57	24.46	1.11	-6.01	8.24
c902106	18	21.60	26.97	-5.37	-13.60	2.85
c903101	14	28.79	27.15	1.64	-7.69	10.96
c904103	11	28.36	24.22	4.14	-6.38	14.67
c904110	11	34.60	25.12	9.48	-1.04	20.00
c905104	12	32.64	35.61	-2.97	-13.04	7.10
c908105	11	32.36	39.65	-7.29	-17.81	3.24
**c909103	12	38.50	28.23	10.27	0.20	20.35
**c910103	17	46.41	31.54	14.88	6.41	23.34
c911102	11	23.84	22.43	1.41	-9.11	11.93
c912103	16	21.29	26.56	-5.27	-13.99	3.45
c912105	10	18.87	21.83	-2.96	-14.00	8.07
c914101	11	23.43	26.43	-3.00	-13.52	7.53
c916101	11	20.82	24.11	-3.29	-13.81	7.23
c919101	10	22.97	25.47	-2.50	-13.54	8.53
c919104	22	28.50	26.29	2.21	-5.23	9.65
c921107	50	25.48	24.56	0.92	-4.02	5.85
c922107	14	31.00	31.84	-0.84	-10.17	8.49
c923108	23	31.86	32.50	-0.64	-7.91	6.64
c927104	10	31.13	29.70	1.43	-9.60	12.47
c927105	11	31.64	38.41	-6.77	-17.29	3.75
c928105	15	25.93	28.43	-2.49	-11.50	6.52
c928108	27	26.90	22.32	4.57	-2.14	11.29
c928110	15	31.09	26.27	4.81	-4.20	13.82
c930102	17	20.47	24.64	-4.17	-12.64	4.29
c933101	17	24.79	24.81	-0.02	-8.48	8.44
c933108	16	28.18	30.88	-2.70	-11.43	6.02
c933202	20	25.05	30.37	-5.32	-13.13	2.48
c933203	11	30.27	23.41	6.86	-3.66	17.39
c934108	28	28.33	31.39	-3.06	-9.65	3.54
c937103	11	17.58	21.20	-3.62	-14.15	6.90
c937106	20	26.55	23.02	3.53	-4.27	11.34
c937107	30	19.85	26.16	-6.31	-12.68	0.06
c938105	12	20.68	26.42	-5.74	-15.82	4.33
c941103	10	21.60	27.81	-6.21	-17.24	4.83
c941108	17	22.65	26.42	-3.77	-12.23	4.69
c942101	12	22.17	28.87	-6.70	-16.77	3.37
c942105	12	27.30	28.63	-1.33	-11.40	8.75
c943101	23	25.45	24.32	1.13	-6.14	8.41
c943109	20	28.45	25.00	3.45	-4.35	11.26
c944101	41	34.73	35.08	-0.36	-5.81	5.09
c944104	10	24.10	29.29	-5.19	-16.22	5.85
c945105	16	26.18	26.69	-0.51	-9.23	8.22
c945107	14	25.85	22.12	3.72	-5.60	13.05
c945110	13	37.80	29.30	8.50	-1.18	18.17
c945112	12	29.26	29.80	-0.54	-10.62	9.53
c948104	19	17.89	25.45	-7.55	-15.56	0.45
c949104	14	32.52	30.53	1.99	-7.34	11.31
c950108	13	26.06	24.15	1.91	-7.76	11.59
c950110	15	24.60	20.09	4.51	-4.50	13.52
c952104	13	28.68	24.25	4.43	-5.25	14.11
c952108	17	27.51	31.40	-3.89	-12.35	4.58
***c952112	12	15.67	28.51	-12.85	-22.92	-2.77
c953106	14	25.03	24.05	0.98	-8.34	10.31
c956103	19	26.86	23.78	3.09	-4.92	11.09
c956104	14	30.76	29.00	1.76	-7.57	11.09
c956106	15	26.67	29.68	-3.01	-12.02	6.00
c958101	16	18.27	26.06	-7.79	-16.51	0.94
c958105	14	21.06	26.48	-5.43	-14.75	3.90

c959107	18	27.06	30.11	-3.05	-11.28	5.17
c960106	11	28.16	32.90	-4.74	-15.26	5.78
c961107	18	25.38	29.70	-4.33	-12.55	3.90
c963105	13	24.59	21.20	3.39	-6.29	13.07
c965104	13	30.30	32.93	-2.63	-12.31	7.05
c965113	12	29.82	28.86	0.96	-9.11	11.04
c966110	16	23.00	24.85	-1.85	-10.57	6.87
c967101	14	24.61	23.76	0.85	-8.48	10.18
c967104	23	26.16	27.89	-1.72	-9.00	5.55
c967106	13	29.34	25.61	3.74	-5.94	13.42
c970101	12	19.33	25.60	-6.27	-16.34	3.81
c970102	13	37.54	31.12	6.42	-3.26	16.10
c971105	12	25.33	27.13	-1.80	-11.87	8.27
c972106	10	33.20	25.58	7.62	-3.41	18.66
c976101	11	19.73	18.48	1.24	-9.28	11.76
c977104	10	34.30	25.23	9.07	-1.97	20.10
c977108	10	22.70	26.54	-3.84	-14.88	7.19
c978104	12	27.92	32.40	-4.49	-14.56	5.59
c979102	16	21.06	20.51	0.55	-8.18	9.27
c980105	14	38.23	30.67	7.56	-1.77	16.89
c980117	44	35.48	36.23	-0.75	-6.01	4.51
c980118	14	30.27	33.73	-3.46	-12.79	5.86
c981103	10	33.23	30.79	2.44	-8.60	13.47
c981202	23	30.69	25.29	5.39	-1.89	12.67
c982308	12	35.60	35.59	0.00	-10.07	10.08

* This table displays only the 85 Consultants for whom full risk-adjusted outcomes data for more than 10 patients was available at 12-months.
**Consultants with patients whose observed SNOT-22 scores were significantly worse ($p < 0.05$) than expected at 12-months.
***Consultant with patients whose observed SNOT-22 scores were significantly better ($p < 0.05$) than expected at 12-months.

Steering group for the National Comparative Audit of Surgery for Nasal Polyposis and Chronic Rhinosinusitis

Mr John Topham (Chair)
Professor Valerie Lund
Mr Robert Slack
Dr Barnaby Reeves
Dr John Browne

Comparative Audit Group of the British Association of Otorhinolaryngologists – Head and Neck Surgeons

Mr Peter Brown (Chair)
Mr Adrian Drake-Lee
Mr Paul Harkness
Miss Claire Hopkins
Mr Raymond Rivron
Ms Rowena Ryan
Mr Robert Slack
Mr John Topham