

## Outcomes after kidney injury in surgery: 1-year follow up

### The OAKS-2 study

A student-driven audit of acute kidney injury following major gastrointestinal surgery

Study protocol v4.0 [final]

18 October 2016



#### Key Study Dates:

|                            |  |
|----------------------------|--|
| Lead meeting:              | Fri 22 <sup>nd</sup> July 2016, RCS(Ed), Birmingham  |
| National meeting:          | Sat 1 <sup>st</sup> October 2016, RCS(Ed), Edinburgh |
| Audit registration period: | October-November 2016                                |
| Data submission deadline:  | Sunday 26 <sup>th</sup> February 2017                |

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Further additional resources can be found at the OAKS study online hub:

<http://www.starsurg.org/project>

## STARSurg Steering Committee

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|                   |                                       |            |
|-------------------|---------------------------------------|------------|
| Aditya Borakati   | Medical Student                       | Hull-York  |
| Aneel Bhangu      | Academic Clinical Lecturer in Surgery | Birmingham |
| Tom Drake         | Foundation Year 1                     | Edinburgh  |
| Edward Fitzgerald | General Surgery Registrar             | London     |
| James Glasbey     | Academic Clinical Fellow in Surgery   | Birmingham |
| Ewen Harrison     | Consultant Surgeon & Senior Lecturer  | Edinburgh  |
| Sivesh Kamarajah  | Medical Student                       | Birmingham |
| Chetan Khatri     | Foundation Year 2                     | Warwick    |
| Kenneth McLean    | Medical Student                       | Edinburgh  |
| Dmitri Nepogodiev | Academic Clinical Fellow in Surgery   | Birmingham |
| Evelina Woin      | Medical Student                       | London     |

## Expert Advisory Group

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|                |   |
|----------------|---|
| Nish Arul      | Renal-ICM Specialist Registrar, London  |
| Samira Bell    | Consultant Nephrologist<br>University of Dundee   |
| Simon Bach     | Senior Lecturer in Surgery<br>University of Birmingham  |
| David Cromwell | Clinical Effectiveness Unit<br>London School of Hygiene & Tropical Medicine                       |
| Fiona Duthie   | Renal Medicine Clinical Research Fellow<br>University of Edinburgh                                |
| Jeremy Hughes  | Professor of Nephrology<br>University of Edinburgh  |
| Rupert Pearse  | NIHR Research Professor & Consultant in Intensive Care Medicine<br>Queen Mary's University London |
| Thomas Pinkney | Senior Lecturer in Surgery<br>University of Birmingham  |
| John Prowle    | Consultant in Intensive Care & Renal Medicine<br>Barts Health NHS Trust, London                   |
| Toby Richards  | Consultant Vascular Surgeon<br>University College London, London                                  |
| Mark Thomas    | Consultant Nephrologist<br>Heart of England NHS Trust, Birmingham                                 |
| Kate Walker    | Clinical Effectiveness Unit<br>London School of Hygiene & Tropical Medicine                       |

## Project timeline

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- July 22, 2016
  - Local Lead meeting, Royal College of Surgeons of Edinburgh (RCSEd) centre in Birmingham.
  - OAKS-2 strategy discussion.
- Oct 1, 2016
  - National STARSurg meeting at RCSEd, Edinburgh.
  - OAKS-2 protocol discussion.
- October-November
  - Local leads co-ordinate recruitment of collaborators.
  - Audit is registered at each participating centre.
- Nov 19, 2016
  - 1-year follow-up data collection commences.
- Feb 26, 2017
  - REDCap database locked, final data submission deadline.

## About STARSurg

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STARSurg was founded in 2013 to empower students to participate in high quality academic projects, forming links with supervising junior doctors and consultants. Students contribute data to national studies whilst gaining an understanding of audit and research methodology and developing communication, teamwork and leadership skills<sup>1</sup>.

The 'collaborative' trainee-led model for 'snapshot' audit has been pioneered in the UK, originally developed as regional networks of surgical registrars. These networks have delivered major multicentre projects including cohort studies and multicentre randomised controlled trials. The background to these has previously been described in the *Lancet*<sup>2</sup>. Our authorship policy designates PubMed-citable co-authorship to all collaborators. An example of this can be seen here:

[ncbi.nlm.nih.gov/pubmed/25091299](https://ncbi.nlm.nih.gov/pubmed/25091299)

Our first study in 2013 saw 258 student collaborators representing 31 UK medical schools collaborate to collect outcomes data on patients undergoing gastrointestinal resection. Over 1500 patients across 109 UK hospitals were included. The results were published in the *British Journal of Surgery*, a world top 5 surgical journal<sup>3</sup>. STARSurg's 2014 study, 'DISCOVER', examined the role of obesity in post-operative complications<sup>4</sup>, with over 1,000 collaborators collecting data on 8,000 patients.



## Introduction and OAKS-1 summary

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The National Confidential Enquiry into Patient Outcome and Death 'Adding Insult to Injury' (2009) report recommended that predictable and avoidable acute kidney injury (AKI) should never occur. Post-operative AKI has previously been associated with increased morbidity, mortality and costs in intra-abdominal surgery<sup>5-6</sup>.

Despite the recognition of AKI as a potentially modifiable driver of post-operative morbidity, there has been a lack of evidence regarding AKI following gastrointestinal and liver surgery.

OAKS-1 was a high-quality, prospective audit with precise outcome reporting. OAKS-1 was run across 176 centres in the UK and Ireland, collecting data on 5,444 patients in September-December 2015. It found that whilst only 81.2% of patients had pre-operative renal function measurement, almost all (98.4%) of patients had their renal function measured post-operatively.

Overall 13.1% of patients developed post-operative AKI. Amongst patients with both pre- and post-operative renal function available, this rose to 15.0%. AKI was strongly associated with increased risk of major post-operative complications.

OAKS-2 will follow-up the patients originally included in the OAKS-1 study, in order to audit their post-discharge care and outcomes. This will inform the prioritisation and design of future post-audit interventions targetted at improving patients' care.



## Audit Gold Standards

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### Primary Audit Standard

*In patients who have suffered AKI, serum creatinine should be measured at least once following discharge from hospital.*

#### **NICE Clinical Guideline 169**

**1.5.16** Monitor serum creatinine after an episode of acute kidney injury. The frequency of monitoring should be based on the stability and degree of renal function at the time of discharge.

#### **Renal Association Acute Kidney Injury Guideline, recommended audit measure:**

Proportion of patients with AKI who recover kidney function, as defined by dialysis independence and return of serum creatinine to within 20% of baseline value (most recent value within 3 months but accepting value up to one year)

### Secondary Audit Standard

*Patients whose eGFR is <30 following recovery from AKI should be assessed in the outpatient clinic by a nephrologist.*

#### **NICE Clinical Guideline 169**

**1.5.16** Consider referral to a nephrologist when eGFR is 30ml/min/1.73m<sup>2</sup> or less in adults who have recovered from an acute kidney injury.

#### **Renal Association Acute Kidney Injury Guideline, recommended audit measure:**

Proportion of AKI survivors with residual chronic kidney disease (CKD) with post-discharge CKD planning.

## Methods

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01

### Summary

Collaborators at sites which participated in OAKS-1 will collect 12-month follow up data on patients who were included in the OAKS-1 audit analysis. Follow up data will be collected for all OAKS-1 patients, including those that did not develop AKI. This will allow the care of AKI patients to be contextualised. Follow up will be completed using electronic hospital records systems. Patients notes will not be reviewed and patients will not be contacted. Collaborators will typically included one medical student and one foundation/core trainee doctor per site.

02

### Study aims

#### *Primary Aim*

To audit adherence to guidelines requiring post-discharge renal function monitoring and clinical follow up in patients who developed acute kidney injury.

#### *Secondary Aim*

To determine the incidence of new or progressive chronic kidney disease, dialysis dependence, and mortality at 1 year follow up.

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### Project Timeline

The last patients included in OAKS-1 were operated on 18<sup>th</sup> November 2015. One year follow up data collection may commence on 19<sup>th</sup> November 2016.

Detailed guidance for centres is available in Appendix C

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### Patients and Centres

#### OAKS-1

- For OAKS-1 all consecutive patients undergoing gastrointestinal resection, liver resection, and reversal of ileostomy or colostomy within the study period were included.
- Patients undergoing appendicectomy, cholecystectomy, hernia repair without bowel resection and transplants were excluded from OAKS-1.

#### OAKS-2

- OAKS-2 will enrol all patients who were included in the OAKS-1 analysis, with the aim of collecting their 1 year outcomes.
- Any hospital that participated in the OAKS-1 study may contribute to OAKS-2, with the following conditions:
  - It must be possible to identify OAKS-1 patients in the REDCap database in order to follow them up (see Section 6).
  - The essential centre survey (OAKS-1 protocol, Appendix C) must have been completed before OAKS-2 is registered.

Appendix D provides a list of centres that participated in OAKS-1 and identifies centres with outstanding centre survey

- Following conclusion of the OAKS study, it is a requirement of participation that mini-teams at each centre should **present the audit findings** to their hospital's surgery and audit departments.

▲ Providing feedback on the audit's findings to your department's clinicians is an essential step in the audit loop. Presenting local results will help collaborators develop analytical and presentation skills and will boost their CVs. ▲

05

**Outcome Measures at 1 year follow up**

- Compliance with NICE Clinical Guideline 169 (see page 6).
- Incidence of new or progressive chronic kidney disease (CKD).
- Review by nephrologist in clinic.
- Dialysis dependence.
- Readmission rate.
- All-cause mortality.
- Days alive out of hospital.

A complete list of data fields and definitions is provided in Appendix A & Appendix B

Collaborators will **not** be required to identify patients with CKD. The national data analysis team will calculate eGFR and CKD stage based on the creatinine values collected. The other variables required to calculate eGFR (age, gender, ethnicity) were already collected as part of the OAKS-1 study.

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**Completing follow up**

In order to complete OAKS-2 it will be necessary to link OAKS-1 REDCap records to patient records on hospital data systems (e.g. pathology results systems). Hospital and NHS patient numbers were only stored in the OAKS-1 REDCap system if specific permission was given by a centre's audit office and Caldicott Guardian.

Detailed instructions on how to complete data collection will be available on the OAKS-2 project hub

If hospital/NHS numbers were not stored on REDCap, a password protected spreadsheet containing a look-up table should have been created. This should cross-reference the automatically generated REDCap ID number for each patient against their NHS number. These look-up tables should have been securely stored on NHS computers by audit office staff and/or the OAKS-1 supervising consultant. Local leads will have details of who holds the look-up table at your centre. Once the audit has been registered, please contact this person to ask for the look-up table to be sent to you.

A guide to using REDCap can be found at the OAKS online hub

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**Data Collation**

Data will be collected and stored online through a secure server running the Research Electronic Data Capture (REDCap) web application. REDCap allows collaborators to enter and store data in a secure system. Collaborators will be given secure REDCap project server login details, allowing secure data storage on the REDCap system. **No** patient identifiable information will be

Printable data proformas are available from the OAKS online hub

uploaded or stored on the REDCap database. Collaborators may wish to first record data on a paper version of the data collection pro-forma. Paper copies of any data should be destroyed as confidential waste within the centre once uploaded to REDCap.

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### Local Project Registration & Data Governance

OAKS-2 should be registered as clinical audit. It is the responsibility of the local collaborator at each site to work with the supervising consultant surgeon to ensure that OAKS-2 is registered appropriately.

When registering OAKS-2 as a clinical audit you can emphasize that:

- All data collected will measure current practice.
- No changes to normal patient pathways/ treatment will be made.
- OAKS-2 is a national audit.

Collaborators should complete the mandatory data governance e-learning module which will be made available on the OAKS project online hub: <http://www.starsurg.org/project>

Appendix D provides a list of centres that participated in OAKS-1 and identifies centres with outstanding centre surveys

REDCap accounts will **not** be issued until evidence is sent to your university's local lead that the following approvals are in place at your centre:

- (i) Successful registration of OAKS with the audit department.
- (ii) Caldicott Guardian permission for data to be submitted to REDCap.
- (iii) In addition a completed OAKS-1 Essential Centre Survey should have been returned to STARSurg. If outstanding, the survey may be completed now.

You **must** have confirmation of successful audit registration prior to commencing data collection. If you encounter difficulties with registering the study, seek advice from your supervising consultant, your local lead, or the STARSurg steering committee.

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### Project team structure

Medical students will take the lead in disseminating and delivering this study, which is supported by a collaboration of medical students, foundation doctors, surgical trainees and consultant surgeons:

- **Steering Committee:** a core group of medical students and supervising surgical trainees and consultant responsible for protocol design, data handling, analysis and drafting of the paper. The Steering Committee are responsible for use of data resulting from the project.
- **Local leads:** a network of medical students across all medical schools.
  - Responsible for co-coordinating data collection at local hospitals.
  - Act as a link between collaborators and the steering committee. They are the first point of contact for local collaborators.

See page 3 for steering committee details.

For local leads' contact details see the STARSurg website.

- Ensure audit outcomes are reported back to the local audit offices and clinical teams.
- **Collaborators:** responsible to collecting and submitting data at their local centre.
- **Consultants:** data collection at each site must be supervised by a consultant surgeon. The consultant sponsors registration of the audit and ensures collaborators act in accordance within governance guidelines. They should also facilitate presentation of local audit results.

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### Authorship

Collaborators, supervising consultants, local leads and steering committee will be eligible for PubMed-citable co-authorship.

#### *Collaborators*

Two collaborators will be needed at each centre to collect follow-up data; one should be a foundation/core trainee doctor and the other should preferably be a medical student. A handful of high volume centres (>60 eligible cases submitted to OAKS-1) may need an additional medical student collaborator to aid data collection.

#### *Consultants*

The consultant who supervised OAKS-1 at each centre should be approached to support the registration of OAKS-2. This consultant (strictly one consultant per centre) **is** eligible for collaborative PubMed citable co-authorship **if** they meet the following criteria:

- (i) Supports local audit registration.
- (ii) Circulates information about the audit and the audit protocol to consultant colleagues.
- (iii) Facilitates presentation of local audit results at a departmental audit meeting.
- (iv) Completes workplace-based assessments for students or trainees (ePortfolio/ISCP), if asked.

#### *Local leads*

To qualify for authorship, local leads must recruit collaborators to complete follow-up at all OAKS-1 centres affiliated to their medical school.

#### *OAKS-1 collaborators*

The OAKS-2 project will collect data on long-term outcomes to supplement detailed patient data collected in the OAKS-1 project. Therefore, all OAKS-1 collaborators will be included as co-authors on any OAKS-2 publications.



## Appendix A: Summary of data fields

|      |  |  |
|------|--|--|
| 1    | Baseline creatinine value                          | Enter value<br><i>If available, record how many days pre-op this value was measured</i>  |
| 2(a) | 45-day creatinine value                            | Enter values<br><i>If available, record whether this result is: community/ outpatient/ elective inpatient/ A&amp;E or emergency inpatient</i><br><i>If available, record how many days post-op this value was measured</i> |
| 2(b) | 90-day creatinine value                            |  |
| 2(c) | Mid-year creatinine value                          |  |
| 2(d) | 1-year creatinine value                            |  |
| 3    | 1-year AKI episodes                                | Enter value  |
| 4    | Post-discharge nephrology review                   | No, Yes  |
| 5    | Post-discharge dialysis                            | No, Yes – but discontinued, Yes – ongoing  |
| 6    | 1-year MI / CVA                                    | No, Yes<br><i>If yes, record number of days post-op first MI/CVA occurred</i>  |
| 7    | 30-day readmission                                 | No, Yes  |
| 8    | Total hospital length of stay over 1-year post-op  | Enter value  |
| 9    | All-cause mortality                                | No, Yes<br><i>If yes, record number of days post-op that patient died</i>  |
| 10   | Number of medications at the time of index surgery | 0, 1-2, ≥3   |

A printable, user-friendly one-page summary of required data fields may be downloaded from the OAKS project online hub: <http://www.starsurg.org/project>

## Appendix B: Data dictionary

The best place to find the necessary information for each data field is indicated in italics below.

**Day of surgery is defines as post-operative day 0. All follow-up is up to and including day 365 post-op.**

| Data field                                  | Data options/ required data          | Data dictionary  |
|---|--------------------------------------|--|
| 1 Baseline creatinine value                 | Enter value<br>( $\mu\text{mol/L}$ ) | <i>(Pathology results system)</i><br>In OAKS-1 the most recent creatinine value up to 90 days preceding surgery was collected. Within the 90 day window, baseline creatinine was not available for around 20% of patients. Therefore to ensure that the care of all patients can be meaningfully audited within OAKS-2, we are collecting extra baseline creatinine data to ensure it is available for all patients.<br><br>Please record the <b>most recent</b> pre-operative creatinine measured <b>up to 1 year</b> <u>preceding</u> the date of index surgery. Record the number of days prior to index surgery that the blood test was taken. |
| 2 (a) First post-discharge creatinine value | Enter value<br>( $\mu\text{mol/L}$ ) | Record the <b>first</b> available measurement taken following discharge (index surgery admission).   |
| (b) 90-day creatinine value                 | Enter value<br>( $\mu\text{mol/L}$ ) | Record the <b>closest</b> available measurement taken to <u>90 days</u> post-op. Measurements taken <b>between 60–119 days post-op</b> may be used.  |
| (c) Mid-year creatinine value               | Enter value<br>( $\mu\text{mol/L}$ ) | Record the <b>closest</b> available measurement taken to <u>180 days</u> post-op. Measurements taken <b>between 120–240 days post-op</b> may be used.  |
| (d) 1-year creatinine value                 | Enter value<br>( $\mu\text{mol/L}$ ) | Record the <b>most recent</b> available measurement taken <u>up until 365 days post-op</u> . <i>e.g. this could be a test taken at 160 days post-op, if that is the most recent result</i>   |

In addition:

(i) record whether each result was from:

- community (GP)
- outpatients (clinic)
- elective (planned) admission
- A&E or emergency admission

(ii) record the number of **days** post-op that each test was taken

*If no blood test data available for any of the fields 2(a),2(b),2(c): record '0' for that field*

*If your trust automatically flags AKI: record whether the patient was in AKI at the time of this test being taken. If so, record the **last preceding** result from when the patient was **not** in AKI.*

|    |   |   |   |
|----|---|---|---|
| 3  | 1-year acute kidney injury episodes               | <ul style="list-style-type: none"> <li>▪ Enter value</li> <li>▪ Automatic AKI reporting not available</li> </ul>  | <p><i>(Pathology results system)</i></p> <p>If your trust's pathology system has automatically flagged AKI since Oct 2015, please record the number of distinct AKI episodes the patient developed between <b>7 – 365 days post-op</b>.</p>   |
| 4  | Post-discharge nephrology review                  | <ul style="list-style-type: none"> <li>▪ No</li> <li>▪ Yes</li> <li>▪ Clinic letters unavailable</li> </ul>   | <p><i>(Patient Administration System – PAS, online clinical letters)</i></p> <p>Include any review as an <b>outpatient</b> by a nephrologist following the original surgery. It may be possible to determine whether the patient has had appointments from PAS system.</p>  |
| 5  | Post-discharge dialysis                           | <ul style="list-style-type: none"> <li>▪ No</li> <li>▪ Yes – but discontinued</li> <li>▪ Yes – ongoing</li> <li>▪ Clinic letters unavailable</li> </ul> | <p><i>(Patient Administration System – PAS, online clinical letters)</i></p> <p>If the patient received dialysis <b>since initial discharge</b>, please record whether the dialysis treatment has been discontinued or remains ongoing at 1-year. It may be possible to determine whether dialysis has been performed from the PAS system.</p>  |
| 6  | 1-year MI / CVA                                   | <ul style="list-style-type: none"> <li>▪ No</li> <li>▪ Yes</li> <li>▪ Discharge and clinic letters unavailable</li> </ul>                               | <p><i>(online discharge letters, online clinical letters)</i></p> <p>Record whether the patient has been diagnosed as having had a myocardial infarction (STEMI/ NSTEMI), stroke or transient ischaemic attack. The diagnosis must have been made by a cardiology specialist (MI) or stroke/neurology/elderly care specialist (CVA).<br/>If <u>yes</u>, record number of <b>days</b> post-op that the <b>first</b> MI/CVA occurred.</p> |
| 7  | 30-day readmission                                | <ul style="list-style-type: none"> <li>▪ No</li> <li>▪ Yes</li> </ul>   | <p><i>(Patient Administration System – PAS, online discharge letters)</i></p> <p>Include inpatient admissions within 30 days of surgery. Do not include A&amp;E attendances.</p>  |
| 8  | Total hospital length of stay over 1-year post-op | Enter days  | <p><i>(Patient Administration System – PAS, online discharge letters)</i></p> <p>Enter the <b>total</b> length of stay in hospital including the <u>index admission</u> and <u>all re-admissions</u>.</p>   |
| 9  | Mortality   | <ul style="list-style-type: none"> <li>▪ No</li> <li>▪ Yes</li> </ul>   | <p><i>(Patient Administration System)</i></p> <p>If <u>yes</u>, record number of <b>days</b> post-op that patient died.</p>   |
| 10 | Number of medications at the of index admission   | <ul style="list-style-type: none"> <li>▪ 0</li> <li>▪ 1-2</li> <li>▪ ≥3</li> <li>▪ Data unavailable</li> </ul>  | <p><i>(online pre-operative surgical or assessment clinic letters. If this is not available please use online discharge summary from index admission but exclude any analgesics/ antiemetics/ antibiotics and other short-term medications from the total)</i></p>  |

## Appendix C: Key steps for successful inclusion of your centre

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For local leads' contact details see the STARSurg site.

1. Contact your **local lead** about participation in the OAKS-2 study.
2. Local leads will co-ordinate collaborator recruitment to OAKS-2. Local leads will be aware which centres are eligible to participate in OAKS-2 and who the supervising consultant at each site was. They will also be able to let you know the system for linking REDCap entries to patient IDs at that centre.
3. A medical student and foundation/trainee doctor should work together at each centre to collect the required data.
4. Ensure that you secure **formal audit approval** from your hospital's clinical audit department prior to commencing data collection. *This may seem daunting at first* but is in fact quite straight forward. Every hospital has an audit department and it is a simple case of approaching them with the information we have prepared in this protocol, and applying this to the local audit registration form. The supervising consultant surgeon at your centre should support you and sign the hospital's audit form.

For more details on REDCap and data security visit the project hub.

Ensure that the audit department know that this is part of a *national project* and that you will enter data on REDCap. Contact your hospital's **Caldicott Guardian** (the audit department can help you find out who this is) to request permission to submit data to REDCap.

**It is essential that you begin this process immediately;** approval can take up to a month. You may have to contact or even visit the hospital before your placement starts to ensure that you will be ready. **If you have any difficulties contact your local lead, your supervising consultant or the steering committee.**

5. Once the audit is registered and you have Caldicott Guardian approval, please forward evidence of this to your university's **local lead**. REDCap accounts will not be issued until proof of audit registration is received.
6. **Collect** follow-up data for all eligible OAKS-1 patients at your centre. This should include all patients (i.e. both those who developed AKI and those who did not). **Detailed instructions on data collection will be available from the OAKS-2 project hub.**
7. Ensure all data has been uploaded to the **REDCap** system and you have completed all fields, avoiding **missing data points**. If more than 5% of patients at your centre are missing data, your centre cannot be included and your name will be withdrawn from the author list.
8. It is a **condition** of participation in OAKS-2 that following completion of the audit at your centre you **must** ensure that your **local results are presented** to your hospital's surgical department and/or reported back to the audit department.

## Appendix D: Centres which participated in OAKS-2

Centres with outstanding centre questionnaires are highlighted in red. Completed questionnaires must be returned to STARSurg before the centre may participate in OAKS-2.

| Medical school | Centre                   | Medical school    | Centre                    |
|----------------|--------------------------|-------------------|---------------------------|
| Aberdeen       | Aberdeen Royal Infirmary | Cardiff           | Glan Clwyd                |
| Aberdeen       | Dr Gray's                | Cardiff           | Prince Charles Hospital   |
| Aberdeen       | Gilbert Bain             | Cardiff           | Princess of Wales         |
| Aberdeen       | Raigmore Inverness       | Cardiff           | Royal Glamorgan           |
| Barts          | Homerton                 | Cardiff           | Royal Gwent               |
| Barts          | King Georges             | Cardiff           | University Hospital Wales |
| Barts          | Newham                   | Cardiff           | Wrexham Maelor            |
| Barts          | Queens                   | Cardiff           | Ysbyty Gwynedd Bangor     |
| Barts          | Royal London             | Dundee            | Ninewells                 |
| Barts          | Whipps Cross             | Dundee            | Perth Royal Infirmary     |
| Belfast        | Altnagelvin Area         | Dundee            | Victoria, Kirkcaldy       |
| Belfast        | Antrim Area              | Edinburgh         | Royal Infirmary Edinburgh |
| Belfast        | Belfast City             | Edinburgh         | Western General Edinburgh |
| Belfast        | Causeway                 | Exeter & Plymouth | Derriford                 |
| Belfast        | Craigavon Area           | Exeter & Plymouth | Royal Cornwall            |
| Belfast        | Daisy Hill               | Exeter & Plymouth | Royal Devon               |
| Belfast        | Mater Belfast            | Exeter & Plymouth | Torbay                    |
| Belfast        | Royal Victoria           | Galway            | Sligo Regional            |
| Belfast        | Ulster                   | Galway            | Ugal                      |
| Birmingham     | Good Hope                | Glasgow           | Ayr                       |
| Birmingham     | Heartlands               | Glasgow           | Crosshouse                |
| Birmingham     | Hereford                 | Glasgow           | Dumfries and Galloway     |
| Birmingham     | Manor Walsall            | Glasgow           | Forth Valley Royal        |
| Birmingham     | New Cross Wolverhampton  | Glasgow           | Glasgow Royal Infirmary   |
| Birmingham     | QE Birmingham            | Glasgow           | Hairmyres                 |
| Birmingham     | Russell's Hall           | Glasgow           | Inverclyde Royal          |
| Birmingham     | Sandwell                 | Glasgow           | Queen Elizabeth           |
| Bristol        | Bath                     | Glasgow           | Royal Alexandra           |
| Bristol        | Bristol Royal Infirmary  | Glasgow           | Wishaw General            |
| Bristol        | Cheltenham               | HYMS              | Castle Hill               |
| Bristol        | Gloucester               | HYMS              | Hull Royal Infirmary      |
| Bristol        | Great Western Swindon    | HYMS              | Princess Diana Grimsby    |
| Bristol        | Musgrove Park            | HYMS              | Scarborough General       |
| Bristol        | Southmead                | HYMS              | Scunthorpe General        |
| Bristol        | Weston General           | HYMS              | York                      |
| Bristol        | Yeovil                   | Imperial          | Charing Cross             |
| BSMS           | Royal Sussex County      | Imperial          | Chelsea and Westminster   |
| Cambridge      | Addenbrookes             | Imperial          | Ealing                    |
| Cambridge      | Bedford                  | Imperial          | Hammersmith               |
| Cambridge      | Hinchingbrooke           | Imperial          | Hillingdon                |
| Cambridge      | Ipswich                  | Imperial          | Northwick Park            |
| Cambridge      | QE Hospital, Kings Lynn  | Imperial          | St Marys                  |
| Cambridge      | West Suffolk Hospital    | Imperial          | West Middlesex            |

| Medical school | Centre                     | Medical school | Centre                      |
|----------------|----------------------------|----------------|-----------------------------|
| Keele          | Royal Shrewsbury Hospital  | Nottingham     | Kings Mill                  |
| Keele          | Royal Stoke University     | Nottingham     | Nottingham City             |
| Kings          | Ashford William Harvey     | Nottingham     | Queens Medical Centre       |
| Kings          | Guys and St Thomas         | Nottingham     | Royal Derby                 |
| Kings          | Kings College Hospital     | Oxford         | John Radcliffe              |
| Kings          | Lewisham                   | Oxford         | Stoke Mandeville            |
| Kings          | Maidstone                  | RCSI           | Connolly                    |
| Kings          | Medway NHS Trust           | SGUL           | Croydon                     |
| Kings          | Princess Royal Orpington   | SGUL           | Epsom                       |
| Kings          | St Richards                | SGUL           | Kingston                    |
| Kings          | Woolwich Queen Elizabeth   | SGUL           | St Georges                  |
| Lancaster      | Royal Lancaster            | SGUL           | St Helier                   |
| Leeds          | Airedale General           | Sheffield      | Chesterfield Royal          |
| Leeds          | Bradford Royal Infirmary   | Sheffield      | Doncaster Royal             |
| Leeds          | Dewsbury                   | Sheffield      | Northern General            |
| Leeds          | Harrogate District         | Southampton    | Basingstoke and North       |
| Leeds          | Huddersfield Royal         | Southampton    | Dorchester                  |
| Leeds          | Pinderfields               | Southampton    | Frimley Park                |
| Leeds          | St James                   | Southampton    | Jersey                      |
| Leicester      | Kettering                  | Southampton    | Poole                       |
| Leicester      | Leicester General          | Southampton    | Queen Alexandra             |
| Leicester      | Leicester Royal Infirmary  | Southampton    | Royal Hampshire Winchester  |
| Leicester      | Peterborough               | Southampton    | Royal Surrey                |
| Liverpool      | Aintree University         | Southampton    | Salisbury                   |
| Liverpool      | Arrowe Park                | Southampton    | Southampton General         |
| Liverpool      | Furness                    | Southampton    | Wexham Park                 |
| Liverpool      | Royal Liverpool            | Swansea        | Carmarthen                  |
| Liverpool      | Southport and Formby       | Swansea        | Morrison                    |
| Liverpool      | Warrington                 | Swansea        | Withybush                   |
| Liverpool      | Whiston                    | TCD Dublin     | St James                    |
| Manchester     | Blackpool Victoria         | TCD Dublin     | Tallaght AMNCH              |
| Manchester     | Manchester Royal Infirmary | UCL London     | Barnet                      |
| Manchester     | Royal Blackburn            | UCL London     | Basildon                    |
| Manchester     | Royal Preston              | UCL London     | Luton                       |
| Manchester     | Salford Royal              | UCL London     | North Middlesex             |
| Manchester     | Stepping Hill              | UCL London     | Royal Free                  |
| Manchester     | UHSM Manchester            | UCL London     | University College Hospital |
| Newcastle      | Cumberland                 | UCL London     | Watford General             |
| Newcastle      | Freeman                    | UCL London     | Whittington                 |
| Newcastle      | James Cook                 | UEA            | Norfolk and Norwich         |
| Newcastle      | North Durham               | UCD Dublin     | St Vincents University      |
| Newcastle      | Northumbria Emergency      | Warwick        | George Eliot                |
| Newcastle      | QE Gateshead               | Warwick        | UHCW Coventry               |
| Newcastle      | Royal Victoria Infirmary   | Warwick        | Warwick                     |
| Newcastle      | South Tyneside             |                |                             |
| Newcastle      | Sunderland                 |                |                             |

## Appendix D: References

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1. Chapman SJ, Glasbey JC, Khatri C et al. Promoting research and audit at medical school: evaluating the educational impact of participation in a student-led national cohort study. *BMC Med Educ.* 2015 Mar 13;15(1):47.
2. Bhangu A, Koliass AG, Pinkney T et al. Surgical research collaboratives in the UK. *Lancet* 2013;382(9898): 1091-1092.
3. STARSurg Collaborative. Impact of postoperative non-steroidal anti-inflammatory drugs on adverse events after gastrointestinal surgery. *Br J Surg.* 2014;101(11):1413-23.
4. STARSurg Collaborative. Multicentre prospective cohort study of body mass index and postoperative complications following gastrointestinal surgery. *Br J Surg.* 2016;103(9):1157-72.
5. Kim M, Brady JE, Li G. Variations in the risk of acute kidney injury across intraabdominal surgery procedures. *Anesth Analg.* 2014 Nov;119(5):1121-32.
6. Teixeira C, Rosa R, Rodrigues N. Acute kidney injury after major abdominal surgery: a retrospective cohort analysis. *Crit Care Res Pract.* 2014;2014:132175.