CovidSurg-3: Outcomes of surgery in COVID-19 infection

PROTOCOL APPENDIX

version 1.0

This Protocol Appendix provides additional information to the main CovidSurg-3 study protocol. The Protocol Appendix should be read in conjunction with the main study protocol, which is available from https://globalsurg.org/covidsurg3.

As the study progresses, this Protocol Appendix may be revised to clarify any queries from collaborators that arise as the study progresses. An up to date document will be available from our website at https://globalsurg.org/covidsurg3.

1 LIST OF EXCLUDED PROCEDURES

CovidSurg-3 inclusion criteria are based on the published GlobalSurg-CovidSurg Week study (COVIDSurg Collaborative. T*iming of surgery following SARS-CoV-2 infection: an international prospective cohort study*. Anaesthesia. 2021 Jun;76(6):748-758.).

In terms of procedure-related inclusion criteria, CovidSurg-3 includes:

- All operations performed in an operating theatre by a surgeon, excluding minor procedures (which are tabulated below).
- All surgical specialties.
- Both elective or emergency surgeries.
- Both day case surgery and inpatient surgeries.
- Both procedures performed with and without general anaesthetic.

Regarding endoscopic procedures (diagnostic or therapeutic) those that are usually performed in an operating theatre by a surgeon are included. Endoscopic procedures that are usually performed outside of an operating theatre (e.g. in an endoscopy suite) or by a non-surgeon are excluded. Interventional radiology procedures are excluded.

The table below maps procedures to the body regions used for the hospital-level component of the study. Minor procedures that are excluded are tabulated in the 'excluded procedures' column below (please check the table carefully to ensure a procedure is not excluded, the search function may be helpful). The list of included procedures below is not exhaustive (indicative only).

Transplant procedures are captured under the relevant body region.

Example included procedures	Excluded procedures
Blood vessels (vascular): Includes aorta, arteries, veins	
>Aortic root/aorta surgery >Carotid enterectomy >Repair of arterial aneurysm >Varicose vein ligation and stripping >Formation of arterio-venous fistula >Embolectomy/thrombectomy >Arterial bypass	>Transluminal (endovascular) procedures on arteries (diagnostic or therapeutic), including with open cut down to the artery >Transluminal (endovascular) procedures on veins (diagnostic or therapeutic), such as endovenous laser treatment (EVLT) >Injection into varicose vein of leg >Insertion or removal of central venous catheter/line (CVC) >Insertion or removal of Hickmann line >Insertion or removal of dialysis catheter
Brain: Includes skull	
>Brain biopsy >Brain excision >Ventriculoperitoneal Shunt insertion >Craniectomy/Craniotomy >Drainage of spaces in the skull	
Colon, rectum and small bowel: Includes appendix	
>Small bowel resection or bypass >Colorectal resection (excision, colectomy) >Stoma formation, refashioning, re-siting and reversal >Repair of perforated duodenal ulcer >Perianal/pilonidal abscess incision and drainage	>Colonoscopy (diagnostic or therapeutic) >Flexible sigmoidoscopy (diagnostic or therapeutic) >Proctoscopy (diagnostic or therapeutic)
Eyes (ophthalmology)	
>Procedures on the iris, retina, vitreous body, cornea, eyelid >Cataract surgery >Glaucoma surgery >Pterygium surgery >Strabismus surgery	>Removal of foreign body from cornea

Female reproductive system: Includes fallopian tubes, ovaries, uterus, vagina	
>Excision of the uterus (hysterectomy) >Uterus repair >Excision of vagina >Repair of vaginal prolapse >Ovarian detorsion >Oophorectomy +/- salpingectomy >Ovarian Cystectomy >Female sterilisation >Ablation/excision of endometrium: >Vulval procedures >Dilatation and curettage >Hysteroscopy + intervention/biopsy	>Cervical biopsy >Colposcopy (diagnostic or therapeutic)
General surgery: Includes breast, endocrine, hernia and miscellaneous emergency surgery	
Endocrine: >Adrenalectomy >Parathyroidectomy >Pituitary gland excision >Thyroidectomy **Breast** >Mastectomy >Lumpectomy >Mammoplasty >Procedures on axillary nodes **Hernia** >Femoral, inguinal, incisional, umbilical hernia repair >Ventral, Spigellian, epigastric hernia repair **Other** >Excision of retroperitoneal sarcoma >Multivisceral resection **Emergency surgery** >Trauma laparotomy >Abdominal exploration and washout >Appendicectomy (open or laparoscopy) >Adhesiolysis (open or laparoscopic) >Diagnostic laparoscopy +/- washout >Diagnostic laparotomy +/- washout	>Ascitic drain (drainage of the peritoneal cavity) >Breast biopsy >Endoscopic ultrasound >Laparoscopic ultrasound >Vacuum dressing
Head & neck: Includes ear, nose, mouth, salivary glands, tonsils, larynx, pharynx, maxillofacial surgery, and surgical tracheostomy	
>Procedures on the cochlear, external auditory meatus, cochlear, inner ear, middle ear, external ear and eardrum. >Excision of larynx >Orthognathic (jaw) surgery >Reduction/fixation of the mandible >Excision of bone of face >Drainage of extra/intra-oral abscesses >Orofacial cleft surgery >Radical and selective neck dissection >Nasendoscopy with intervention >Nasal fracture reduction >Endoscopic sinus surgery >Surgical arrest of bleeding from the internal nose >Excision of pharynx >Excision of submental, submandibular and parotid gland. >Partial/total glossectomy >Tongue tie division (lingual frenectomy) >Tonsillectomy >Excision of adenoids >Surgical tracheostomy	>Implantation of tooth >Insertion of dental prosthesis >Orthodontic operations >Restoration of tooth >Extraction of tooth >Nasendoscopy (diagnostic or therapeutic) >Laryngoscopy (diagnostic or therapeutic) >Packing of cavity of the nose >Percutaneous tracheostomy
Heart: Includes mediastinum and pericardium	
>Valvular surgery >Atrial/ventricular septal defect repair >Coronary artery bypass graft >Heart transplant	>Transluminal balloon angioplasty of coronary artery >Insertion of cardiac pacemaker >Percutaneous coronary intervention (PCI)

Hepatobiliary system: Includes bile ducts, gallbladder, liver, pancreas, spleen	
>Cholecystectomy >Liver resection >Liver transplantation >Distal pancreatectomy >Pancreaticoduodenectomy >Splenectomy:	>Endoscopic retrograde cholangiopancreatography [ERCP] (diagnostic or therapeutic) >Liver biopsy
Lung: Includes pleura and chest wall	
>Resection of lung or chest wall >Resection of mediastinal mass >Lung transplantation	>Bronchoscopy (diagnostic or therapeutic) >Chest drain
Musculoskeletal: Includes bones, joints, muscles, tendons, and spinal surgery	
>Amputation of foot, leg, toe >Ligament repair >Arthroscopy of joint >Limb fracture surgery >Debridement and irrigation joint >Fasciotomy >Joint replacement >Muscle/tendon repair >Carpal tunnel release >Nailbed surgery **Spinal:** >Cranial nerve, peripheral nerve, sympathetic nerve operation >Vertebral procedures >Decompression/excision of intervertebral disc >Laminectomy	>Bone biopsy >Injection into the joint >Muscle biopsy >Lumbar (spinal) puncture >Therapeutic epidural injection
Obstetric	
>Caesarean section >Evacuation of contents of uterus/ manual removal of placenta >Repair of obstetric laceration (3/4th degree)	>Any vaginal delivery (normal delivery, breech delivery, forceps delivery, vacuum delivery) >Surgical termination of pregnancy
Oesophagus and stomach	
>Nissen's fundoplication, Hellor myotomy >Oesophagectomy, oesophagogastrectomy >Gastrectomy >Primary / revision of anti-reflex operation >Perforated peptic ulcer repair	>Oesophago-gastro-duodenoscopy [OGD] (diagnostic or therapeutic)
Skin (plastic surgery): Includes burns surgery and flaps	
>Excision of benign and malignant skin lesion >Excision of sebaceous cyst >Repair of skin laceration >Abdominoplasty >Burns debridement, excision, dressing and reconstruction. >Flap (local and free) or skin graft	>Skin biopsy (including shave biopsy of skin)
Urinary and male reproductive systems: Includes kidney, bladder, ureter, prostate, testicles, renal transplant	
>Nephrectomy >Percutaneous nephrolithotomy >Transplantation of kidney >Cystectomy >Transurethral resection of bladder (TURBT) >Transurethral resection of prostate (TURP) >Female incontinence surgery >Circumcision >Male sterilisation >Hydrocele/varicocele surgery >Testicular exploration >Insertion of ureteric stent >Rigid cystoscopy under general anaesthesia	>Bladder biopsy >Extracorporeal shock wave lithotripsy (ESWL) >Flexible cystoscopy (diagnostic) >Percutaneous nephrostomy

2 OUTCOME DEFINITIONS

2.1 Unexpected post-operative ventilation

Unexpected postoperative ventilation was defined as:

- Any episode of non-invasive ventilation, invasive ventilation, or extracorporeal membrane oxygenation after initial extubation after surgery, **OR**
- Patient could not be extubated as planned after surgery.

2.2 Acute Respiratory Distress Syndrome

Acute Respiratory Distress Syndrome (ARDS) is an acute diffuse, inflammatory lung injury, leading to increased pulmonary vascular permeability, increased lung weight, and loss of aerated lung tissue with hypoxemia and bilateral radiographic opacities. The Berlin consensus definition[1] will be used:

Acute Respiratory Distress Syndrome criteria - ALL 4 CRITERIA REQUIRED	
1. Timing	Within 1 week of known clinical insult or worsening respiratory symptoms
2. Chest imaging	Bilateral opacities (not fully explained by effusions / collapse / nodules).
3. Origin	Respiratory failure (not fully explained by cardiac failure / fluid overload).
4. Oxygenation	Mild: 200mmHg < PaO_2/FIO_2 ≤ 300mmHg with PEEP or CPAP ≥5cm H_2O Moderate: 100mmHg < PaO_2/FIO_2 ≤ 200mmHg with PEEP ≥5cm H_2O Severe: PaO_2/FIO_2 ≤ 100mmHg with PEEP ≥5cm H_2O *CPAP: continuous positive airway pressure; FIO_2: fraction of inspired oxygen; PaO_2: partial pressure of arterial oxygen; PEEP: positive end-expiratory pressure.*

2.3 Postoperative pneumonia

The US Centers for Disease Control (CDC) definition of pneumonia[3] will be used, modified to accommodate limited availability of radiological facilities at some participating centres:

At least **one** of the following:

- Fever (>38°C) with no other recognised cause.
- Leucopaenia (white cell count <$4x10^9$) or leucocytosis (white cell count >$12x10^9$).
- For adults >70 years old, altered mental status with no other recognised cause.

AND at least **TWO** of the following:

- New onset of purulent sputum or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements.
- New onset or worsening cough, or dyspnoea, or tachypnoea.
- Rales, crackles or bronchial breath sounds.
- Worsening gas exchange (hypoxaemia, increased oxygen requirement).

Wherever possible, the diagnosis should be confirmed with a chest radiograph. The following findings confirm pneumonia:

- New or progressive and persistent infiltrates.
- Consolidation.

- Cavitation.

2.4 Deep vein thrombosis

Deep vein thrombosis (DVT)[2-3] is defined as lower limb deep vein thrombosis with or without symptoms, proven by:

- Lower extremity ultrasonography revealing non-compressibility at the trifurcation of the popliteal vein or above, **OR**
- Computed tomography (CT) venography demonstrating a constant intraluminal filling defect above the trifurcation of the popliteal vein.

2.5 Pulmonary embolism (PE)

Pulmonary embolism (PE)[2-3] is defined as:

- Symptomatic PE confirmed by imaging (computed tomography pulmonary angiogram (CTPA) demonstrating new intraluminal filling defect in a subsegmental or greater sized pulmonary artery; or ventilation/perfusion scanning with a high probability of PE; or pulmonary angiograph demonstrating PE), **OR**
- Fatal PE discovered at autopsy or as judged by the clinical team.

2.6 Postoperative critical care (ITU) admission

Critical care (ITU) is defined as a service that provides close observation and invasive treatment than is not available on general wards, usually reserved for patients with potential or established organ failure[4].

Planned Critical Care Admission: A postoperative admission to critical that was planned prior to surgery due to expectation the patient would either require close monitoring in critical care or organ support; the patient went directly from theatre to critical car as planned.

Unplanned Critical Care Admission: A post-operative admission to critical care that was **not** planned pre-operatively; the patient was admitted either directly from theatre or from the postoperative ward due to deterioration (e.g. unexpected requirement for organ support).

References:

1. ARDS Definition Task Force, Ranieri V, Rubenfeld, GD, Thompson, BT, Ferguson, ND, Caldwell, E, Fan, E, Camporota, L, Slutsky, AS. Acute respiratory distress syndrome: the Berlin Definition. JAMA. 2012;307(23):2526-33.
2. Shalhoub J, Lawton R, Hudson J, Baker C, Bradbury A, Dhillon K, et al. Graduated compression stockings as adjuvant to pharmaco-thromboprophylaxis in elective surgical patients (GAPS study): randomised controlled trial. BMJ. 2020 May 13;369:m1309.
3. van der Hulle T, Cheung WY, Kooij S, Beenen LFM, van Bemmel T, van Es J, et al. Simplified diagnostic management of suspected pulmonary embolism (the YEARS study): a prospective, multicentre, cohort study. Lancet. 2017 Jul 15;390(10091):289-297.
4. Smith G, Nielsen M. ABC of intensive care. Criteria for admission. *BMJ*. 1999;318(7197):1544-1547.

3 STATISTICAL ANALYSIS PLAN

CovidSurg-3 is registered at clinicaltrials.gov with registration NCT05161299, online link: https://clinicaltrials.gov/ct2/show/NCT05161299.

The primary aim of CovidSurg-3 is to determine the predictors for mortality and postoperative pulmonary complications in patients who develop perioperative SARS-CoV-2 infection in the contemporary setting.

The primary outcome is 30-day mortality. The secondary outcomes are 30-day postoperative pulmonary complication and 30-day venous thromboembolism (definitions in Appendix 2).

The study will be conducted according to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) and SAMPL guidelines (Statistical Analyses and Methods in the Published Literature).

The analysis will describe the primary and secondary outcomes in the cohort. Outcomes will be reported stratified by age, sex, ASA grade, urgency of surgery, grade of surgery, country income, and vaccination and previous infection status. Grade of surgery will be determined based on procedure, as in previous studies[1-2].

Non-parametric data will be summarised with medians and interquartile ranges and differences between groups tested using the Mann-Whitney U test. The $\chi 2$ test was used for categorical data. Missing data will be included in flowcharts and summary tables, allowing denominators to remain consistent in calculations.

Hierarchical multivariable, mixed-effects logistic regression will be used to identify risk predictors of 30-day mortality and 30-day postoperative pulmonary complications summarised as odds ratios and 95% confidence intervals. Clinically plausible patient, disease, operation and location specific factors have been selected *a priori* for inclusion in adjusted analyses based on previous studies[1-2]: age sex, ASA grade, indication for surgery, urgency of surgery, grade of surgery, timing of SARS-CoV-2 diagnosis, in addition to vaccination and previous infection status.

Sensitivity analyses will be performed including only those patients who had a positive PCR swab.

Subgroup group analyse will be performed by vaccination and previous infection status.

We anticipate recruitment from approximately 400 hospitals around the world with a mean of 5 patients per hospital, providing a sample size estimate of 2,000 patients. Hospital-level data will not be released. Country-level analyses will only be conducted with permission of National Leads. Local investigators can access their local data at any time directly from REDCap.

References:

1. COVIDSurg Collaborative. *Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study*. Lancet. 2020 Jul 4;396(10243):27-38.
2. COVIDSurg Collaborative. *Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study*. Anaesthesia. 2021 Jun;76(6):748-758.).

4 REDCAP DATA COLLECTION PLATFORM

A formal letter confirming the details of the REDCap data collection platform is available from our website at https://globalsurg.org/covidsurg3.

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. The REDCap server is managed by the University of Birmingham, UK. Only non-patient data will be uploaded to the database. No patient identifiable data will be collected.

REDCap databases at the University of Birmingham have been successfully used for a number of international studies, including:

- CovidSurg Study (1,040 participating sites across 85 countries), ref: COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. Lancet. 2020;396(10243):27-38.
- GlobalSurg-CovidSurg Week (1,650 participating sites across 116 countries), ref: COVIDSurg Collaborative, GlobalSurg Collaborative. *Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study*. Anaesthesia. 2021 Jun;76(6):748-758
- European Society of Coloproctology 2017 Left Colon and Rectal Resection Study (335 participating sites across 49 countries), ref: 2017 European Society of Coloproctology (ESCP) Collaborating Group. *The 2017 European Society of Coloproctology (ESCP) international snapshot audit of left colon, sigmoid and rectal resections - Executive Summary*. Colorectal Dis. 2018;20.

The REDCap database used for the CovidSurg-3 cohort study is run by the NIHR Global Health Research Unit on Global Surgery, within the University of Birmingham Virtual Machine architecture which is physically secured. The architecture is the responsibility of the Storage and Virtualisation Team at the University of Birmingham, Edgbaston, Birmingham, B15 2TT. “At rest” encryption is in place on the database server. Raw data will be stored and will remain at the Birmingham site; it will not be offshored to any other location. The site is physically secure. The virtual hosting service is designed to have no single point of failure with physical redundancy deployed for server, network and storage infrastructure. The virtual server software supports live migration of virtual machines between the physical servers called hosts. Live migration is automatically performed to balance the server load across available infrastructure. On physical server failure the virtual machine is automatically restarted on another host. During host maintenance or intrusive maintenance of the virtual server software, virtual machines are manually migrated to prevent any interruption to service. All physical infrastructure is monitored and automatic alerts generated to systems staff on any failure. All virtual machines are not installed on a single physical server but a range of hosts on which virtual machines automatically live migrate on. Therefore, since there is no one physical location for our machine, it can be considered physically secure. All physical infrastructure and the virtual server software are maintained by the University of Birmingham IT Services. All physical infrastructure is monitored and automatic alerts generated to systems staff on any failure.

The security of the study REDCap database system is governed by the policies of the University of Birmingham UK, in accordance with the requirements of the General Data Protection Regulations (GDPR). The study will be conducted at collaborating sites in accordance with the country-specific data protection requirements. Once data collection is complete, the electronic research files containing anonymised data will be stored on secure non-networked desktop computers for up to 25 years, in line with current

regulations. Access will be restricted to the researchers themselves. Personal data will remain securely at local hospitals.

No sensitive or identifiable data will be collected on the database; the patient's clinical team will only upload on-identifiable data. Access to data will be restricted, each individual collaborator entering data for CovidSurg-3 will have their own username and password. Each patient will be allocated a unique study number at entry. The central research team will not have any access to patient identifiable data. All communication will use this study number. All data will be analysed and reported in summary format. No individual patient data will be identifiable in public reports.

5 STUDY APPROVALS

Hospital Leads are responsible for obtaining necessary local approvals at each participating site in line with hospital and country regulations. Collaborators will be required to confirm that a local approval is in place at the time of uploading each patient record to the study database.

In all approvals processes it should be highlighted that:

- The study will be conducted in accordance with national and international guidelines and legislation, as well as the basic principles of the protection of the rights and dignity of Human Beings, as set out in the Helsinki Declaration.
- This is an **investigator-led, non-commercial** study. A formal letter confirming this is available from our website at https://globalsurg.org/covidsurg3.
- This is an **observational study** (no changes to patient care) study, which is extremely low risk.
- Only routinely available non-identifiable data will be collected.

5.1 Approvals in hospitals that participated in previous CovidSurg studies

CovidSurg-3 is an extension of the previous CovidSurg-1 and GlobalSurg-CovidSurg Week studies.

In hospitals that participated in either the CovidSurg-1 and/or GlobalSurg-CovidSurg Week, collaborators should explore with the relevant committee (e.g. research ethics committee or institutional review board) whether this extension (CovidSurg-3) can be registered as a substantial amendment to the existing CovidSurg-1 / GlobalSurg-CovidSurg Week approval. If it is decided that a new approval is needed, please explore with your ethics committee/IRB whether it is possible to expedite the process in view of the urgency of the pandemic/ Omicron wave.

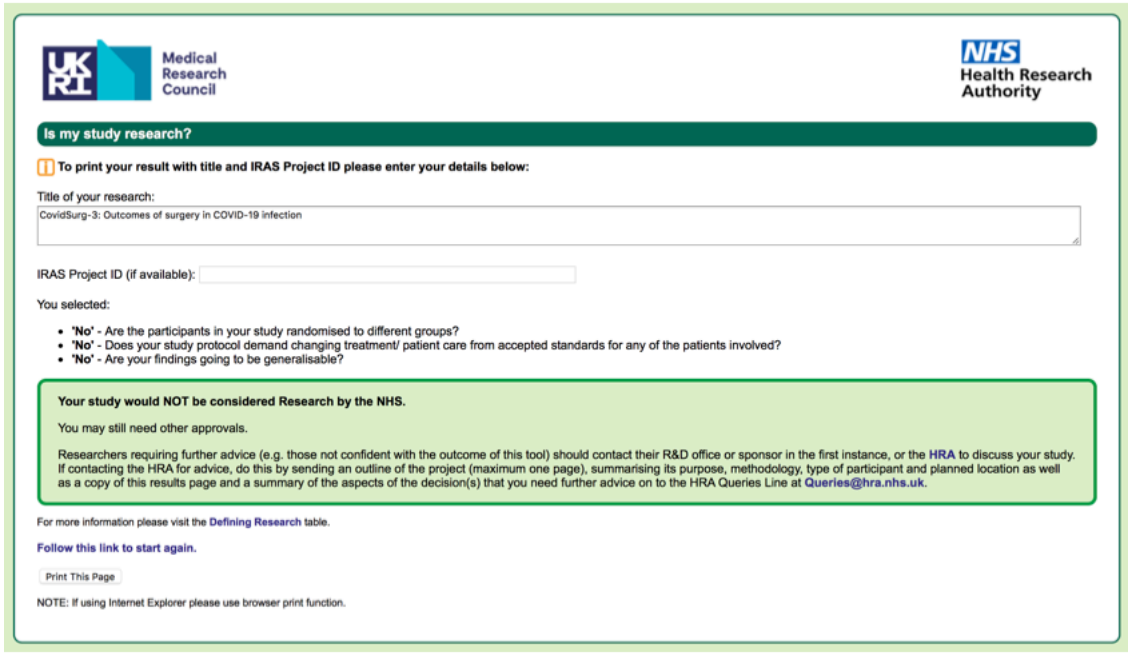
When requesting consideration of this extension as a substantial amendment, the following rationale should be given for why this is appropriate:

- CovidSurg-3 is coordinated by the same research group (CovidSurg Collaborative, based at the University of Birmingham, UK) as the preceding CovidSurg-1 and GlobalSurg-CovidSurg Week studies.
- All the studies are focused on the same topic: the impact of SARS-CoV-2 infection on postoperative outcomes.
- The primary (30-day mortality) and secondary (30-day pulmonary complications) outcome measures are the same across all studies.
- The principles of the data collection are the same in all the studies. They are all observational studies which do not require any changes to normal patient care. No additional tests or follow-up are required in any of these studies.
- The core data points in CovidSurg-3 remain the same as in the preceding studies, although some additional data points have been added on the case report form to address issues relating to vaccination and previous infection.
- The data collection platform is the same in all the studies. Data can be anonymised and uploaded to a secure, online REDCap database. The same REDCap server will be used for CovidSurg-3 as for the preceding CovidSurg-1 and GlobalSurg-CovidSurg Week studies.
- The key difference between CovidSurg-3 and the preceding studies is that some data fields have been removed, whilst new a small number of additional data fields have been added.

Formal letters outlining the relationships between the CovidSurg-1 / GlobalSurg-CovidSurg Week studies and CovidSurg-3 are available from our website at https://globalsurg.org/covidsurg3.

5.1 Approvals in the UK

In the United Kingdom CovidSurg-3 should be **NOT** be registered as research. The Health Research Authority (HRA) decision tools have been used to confirm that this study is not considered research by the NHS and does not require NHS research ethics committee (REC) approval.



Medical Research Council

NHS Health Research Authority

Is my study research?

To print your result with title and IRAS Project ID please enter your details below:

Title of your research:

CovidSurg-3: Outcomes of surgery in COVID-19 infection

IRAS Project ID (if available):

You selected:

- **'No'** - Are the participants in your study randomised to different groups?
- **'No'** - Does your study protocol demand changing treatment/ patient care from accepted standards for any of the patients involved?
- **'No'** - Are your findings going to be generalisable?

Your study would NOT be considered Research by the NHS.

You may still need other approvals.

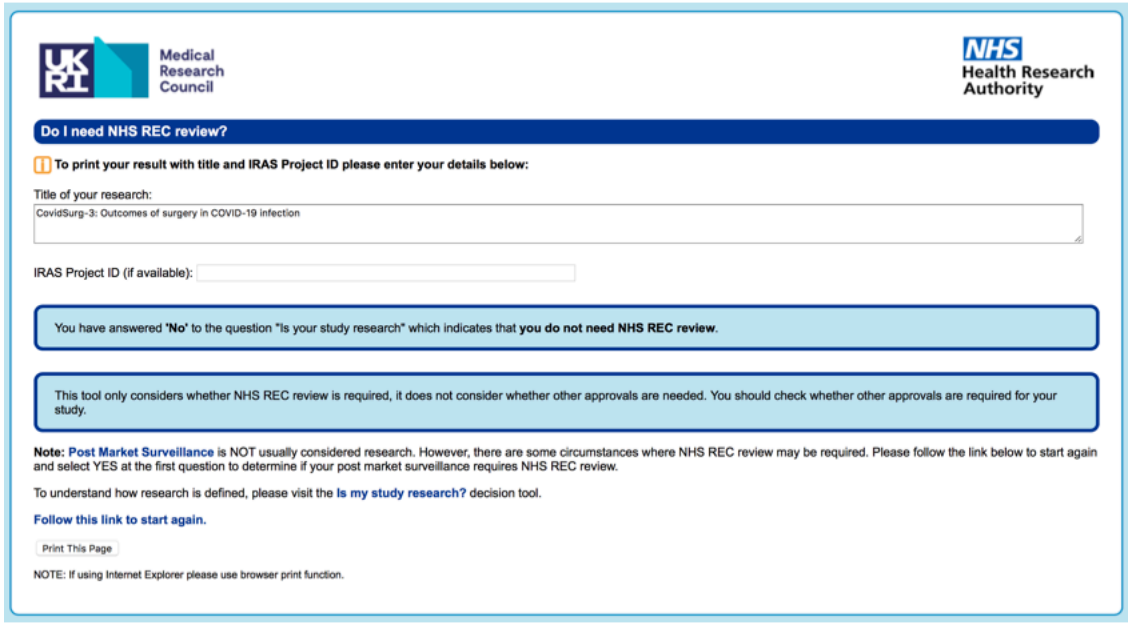
Researchers requiring further advice (e.g. those not confident with the outcome of this tool) should contact their R&D office or sponsor in the first instance, or the HRA to discuss your study. If contacting the HRA for advice, do this by sending an outline of the project (maximum one page), summarising its purpose, methodology, type of participant and planned location as well as a copy of this results page and a summary of the aspects of the decision(s) that you need further advice on to the HRA Queries Line at Queries@hra.nhs.uk.

For more information please visit the Defining Research table.

Follow this link to start again.

Print This Page

NOTE: If using Internet Explorer please use browser print function.



Medical Research Council

NHS Health Research Authority

Do I need NHS REC review?

To print your result with title and IRAS Project ID please enter your details below:

Title of your research:

CovidSurg-3: Outcomes of surgery in COVID-19 infection

IRAS Project ID (if available):

You have answered **'No'** to the question "Is your study research" which indicates that **you do not need NHS REC review**.

This tool only considers whether NHS REC review is required, it does not consider whether other approvals are needed. You should check whether other approvals are required for your study.

Note: Post Market Surveillance is NOT usually considered research. However, there are some circumstances where NHS REC review may be required. Please follow the link below to start again and select YES at the first question to determine if your post market surveillance requires NHS REC review.

To understand how research is defined, please visit the Is my study research? decision tool.

Follow this link to start again.

Print This Page

NOTE: If using Internet Explorer please use browser print function.

CovidSurg-3 should be registered as **clinical audit** in hospital participating in the United Kingdom. This is because:

- The study is measuring the delivery of current care (see audit standards below).
- It will be collecting routine patient data only; all data will be collected from existing medical records.
- No changes will be made to patients' pathways; they will receive normal care.
- All data will be anonymised on the study database.

The following audit standards will be assessed in this study:

1. *Emergency patients should be tested for SARS-CoV-2 on admission*.
   Audit standard 100%. Based on NHS England guidance[1].

2. *Elective patients should receive double SARS-CoV-2 vaccination at least two weeks before surgery*.
   Audit standard 100%. Based on joint Association of Anaesthetists, Federation of Specialty Surgical Associations, Royal College of Anaesthetists, and Royal College of Surgeons guidance[2].

3. *Elective surgery should not be scheduled within7 weeks of a diagnosis of SARS-CoV-2 infection, unless outweighed by the risk of deferring surgery such as disease progression or clinical priority*.
   Audit standard 100%. Based on joint Association of Anaesthetists, Federation of Specialty Surgical Associations, Royal College of Anaesthetists, and Royal College of Surgeons guidance[2].

4. *Elective surgery should not be cancelled on the planned day of surgery due to insufficient critical care capacity*
   Audit standard 100%. Based on Royal College of Anaesthetists guidance[3-4].

5. *Overall 30-day postoperative mortality*.
   Audit standard: should not exceed 23.8%, based on benchmarking against international data[5].

6. *Overall 30-day postoperative pulmonary complications*.
   Audit standard: should not exceed 51.2%, based on benchmarking against international data[5].

References:

1) NHS England. Operating framework for urgent and planned services in hospital settings during COVID-19. Accessed online on 10 December 2021 at: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/05/Operating-framework-for-urgent-and-planned-services-within-hospitals.pdf

2) El-Boghdadly K, Cook TM, Goodacre T, et al. SARS-CoV-2 infection, COVID-19 and timing of elective surgery: A multidisciplinary consensus statement. Anaesthesia. 2021 Jul;76(7):940-946.

3) Owen N. Unplanned critical care admission after elective surgery. In: The Royal College of Anaesthetists (2020). Raising the Standards: RCoA Quality Improvement Compendium. Accessed online on 10 December 2021 at: https://www.rcoa.ac.uk/sites/default/files/documents/2020-08/21075%20RCoA%20Audit%20Recipe%20Book_Combined_Final_25.08.2020_0.pdf

4) Miller KL, Hinde T, Russon K. Minimising day surgery cancellations/failure to attend. In: The Royal College of Anaesthetists (2020). Raising the Standards: RCoA Quality Improvement Compendium.

Accessed online on 10 December 2021 at: https://www.rcoa.ac.uk/sites/default/files/documents/2020-08/21075%20RCoA%20Audit%20Recipe%20Book_Combined_Final_25.08.2020_0.pdf

5) COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. Lancet. 2020 Jul 4;396(10243):27-38.

6 DATA DICTIONARY

This document will guide you through data entry for CovidSurg-3. Please complete all fields that appear on each REDCap record. In order to provide high quality data to inform the global surgical community, it is essential that all data is as complete as possible.

[1] Baseline information form

Data field	Notes
[1-1] Date of operation	For data protection reasons, only week (not full date) collected on REDCap. Select week based on timing of skin-to-knife in theatre. Information on week of operation is important in order to match to country-level statistics on spread of Omicron.
[1-2] Age	Select appropriate age band based on the patient's age on the day of surgery. A categorical classification is used for data protection reasons.
[1-3] Sex	Sex as assigned at birth.
[1-4] Revised Cardiac Risk Index	Tick **all** the comorbidities that apply for this patient. • Ischaemic heart disease includes myocardial infarction, angina, history of Coronary artery bypass graft surgery, or history of percutaneous transluminal coronary angioplasty. • Congestive heart failure. • Cerebrovascular disease includes both stroke or transient ischaemic attack (TIA). • Diabetes mellitus includes both type 1 or type 2 diabetes mellitus. • Preoperative creatinine refers to creatinine measured prior to hospital admission (if available). If pre-admission creatinine is not available, please use the first available creatinine on hospital admission. If there is no hospital record to confirm whether a patient has a comorbidity, please consider the patient to not have that comorbidity. If the patient has none of the listed comorbidities, tick "None of the above".
[1-5] American Society of Anesthesiologists (ASA) grade	ASA grade at the time of surgery. Definitions: (1) Healthy person (2) Mild systemic disease (e.g. hypertension). (3) Severe systemic disease (e.g. severe ischaemic heart disease). (4) Severe systemic disease that is a constant threat to life. (5) A moribund person who is not expected to survive without the operation. Full definitions are available from: https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system
[1-6] Preoperative respiratory support	Select the **highest** level of support the patient required on hospital admission *prior* to undergoing surgery.
[1-7] VTE prophylaxis	Tick **all** options that applied in the postoperative period whilst in hospital. Pharmacological VTE prophylaxis includes clopidogrel, warfarin, new oral anticoagulant (e.g. apixaban, dabigatran, rivaroxaban), fondaparinux, low molecular weight heparin (e.g. dalteparin, enoxaparin). Aspirin **not** included. Mechanical VTE prophylaxis includes anti-embolism stockings or intermittent pneumatic compression.

[2] SARS-COV-2 form

Data field	Notes
[2-1] COVID-free surgical pathways	A hospital that admits COVID-19 patients is defined as one that admit patients for the treatment of COVID-19 under any specialty (e.g. including COVID-19 patients admitted to medical specialties). A segregated COVID-19 free surgical pathway is defined as a hospital policy of segregation of all area in which this patient was treated, away from areas treating COVID-19 patients (including operation theatre, recovery area, critical care and ward). However, within this definition staff members may be involved in the care of both COVID and non-COVID patients.
[2-2] Pre-operative screening	Please indicate if SARS-CoV-2 PCR swab and/ or rapid antigen tests were used to screen for SARS-CoV-2 in the 7 days before surgery (day of surgery is day 0). These tests could be performed in hospital as an outpatient or inpatient, or in the community.
[2-3] Timing of SARS-COV-2 diagnosis	The timing of diagnosis is determined by whether the test sample was taken before surgery (preoperative diagnosis) or after surgery (postoperative diagnosis). If a test sample was taken before surgery but the result was only available after surgery, they should still be recorded as having a preoperative diagnosis.
[2-4] Method of SARS-COV-2 diagnosis	Please indicate if SARS-CoV-2 PCR swab and/ or rapid antigen tests were used to diagnose SARS-CoV-2. Note: patients who did **not** have a positive PCR swab test or rapid antigen test (if confirmatory PCR swab is not available) result are excluded from the study. Patients who have had a positive rapid antigen test **followed** by a negative **confirmatory** PCR test should be excluded.
[2-5] SARS-CoV-2 variant	Please indicate whether a specific SARS-CoV-2 variant is either confirmed (based on sequencing) or suspected (for example, based on S-gene target failure) for this patient. This field may be left as 'not known' if appropriate. Note: Patients can be included regardless of whether a specific variant is suspected or unknown.
[2-6] Previous SARS-CoV-2 positive tests	Please indicate whether the patient has had a previous positive SARS-CoV-2 PCR swab or rapid antigen test **more** than 7 days before surgery (day of surgery is day zero) and, if yes, timing of the most **recent** positive test.
[2-7] SARS-CoV-2 vaccination	Please indicate the total number of SARS-CoV-2 doses the patient has had. If SARS-CoV-2 vaccination(s) were administered to the patient, please select the vaccine used for each dose (dropdown menu in REDCap) and the timing of the most **recent** vaccine dose.

[3] Intraoperative form

Data field	Notes
[3-1] Urgency of Surgery	Urgency of surgery is determined by whether surgery took place on a planned hospital admission or not • Elective surgery: planned admission to hospital for surgery. • Emergency surgery: unplanned admission to hospital. Surgery may take place on the same day as the patient is admitted to hospital, or several days or weeks after hospital admission.
[3-2] Procedure	The drop-down menu includes an extensive list of procedures. Please choose the **most suitable** code for the **main** procedure that the patient underwent. For example, if a patient underwent appendicectomy and laparoscopic washout, please record this as appendicectomy (the main procedure performed). If the specific procedure a patient had is not listed, there are general options within each body system (e.g. 'BRAIN & SKULL - any other procedures not listed') which can be selected. There is no option to enter free text. If you are collecting data on paper forms, please write down the full procedure name on in the space provided on the form. You can later select the most appropriate code when you are entering the data on to REDCap.
[3-3] Anaesthesia	Please select whether the patient received general anaesthesia.
[3-4] Indication for Surgery	The indications for surgery are defined as follows: • Benign disease: any disease/ condition that is not a cancer or related to trauma. Procedures relating to childbirth (obstetrics) may be included under this option also. • Malignancy: suspected or confirmed cancer. • Trauma: any cause of injury, including burns.
[3-5] Operative Approach	Minimally invasive surgery is defined as any technique that makes use of specific instruments designed to reduce the invasiveness of the procedure / incision required. For example, this can include laparoscopic, thoracoscopic, arthroscopic, and robotic procedures. Laparoscopy-assisted procedures (i.e. where a small incision is made to allow extra-corporeal anastomosis, or to have an extraction site for the specimen) and hybrid procedures (where an open approach is used for one body compartment [e.g. abdomen] and a minimally invasive approach is used for another body compartment [e.g. chest]) should be classified as minimally invasive surgery for this study. "Minimally invasive surgery converted to open" includes any procedure which initially started as minimally invasive but where a decision was made during the surgery to switch to an open approach.

[4] 30-day outcomes form

The 30-day outcomes should only include complications / mortality up to and including postoperative day 30 (the day of surgery is day 0). The 30-day outcomes form should be completed after the patient has reached postoperative day 30. The form can be completed either on day 30 or at any point after this.

Please note that 30-day follow-up should be based on existing hospital records. For this study there should be no changes to normal patient care/pathways, so no additional clinic or telephone follow-up should be completed for this study. Follow-up should be based on all information routinely available at 30-days, for example:

- Inpatient hospital notes (paper or electronic) relating to the index admission and any readmissions that the patient has had.
- Records from outpatient (clinic) reviews or telephone calls (if such reviews/ calls are routine practice at the hospital).
- Review of electronic hospital records to identify readmissions.
- Review of electronic hospital records to identify patients recorded as having died.

Data field	Notes
[4-1] Mortality	This is the primary outcome measure for the study. Please take particular care that 30-day mortality is accurately recorded for **all** patients.
[4-3] Complications	From the list provided, please select all the complications the patient experienced up to and including postoperative day 30. If the patient did not experience any of the listed complications, please tick "None of the above". Please refer to the Appendix 2.1-2.5 for full definitions of these complications. Please note, we are not collecting data on any other specific complications.
[4-3] Postoperative critical care	Please refer to the Appendix 2.6 for definitions.