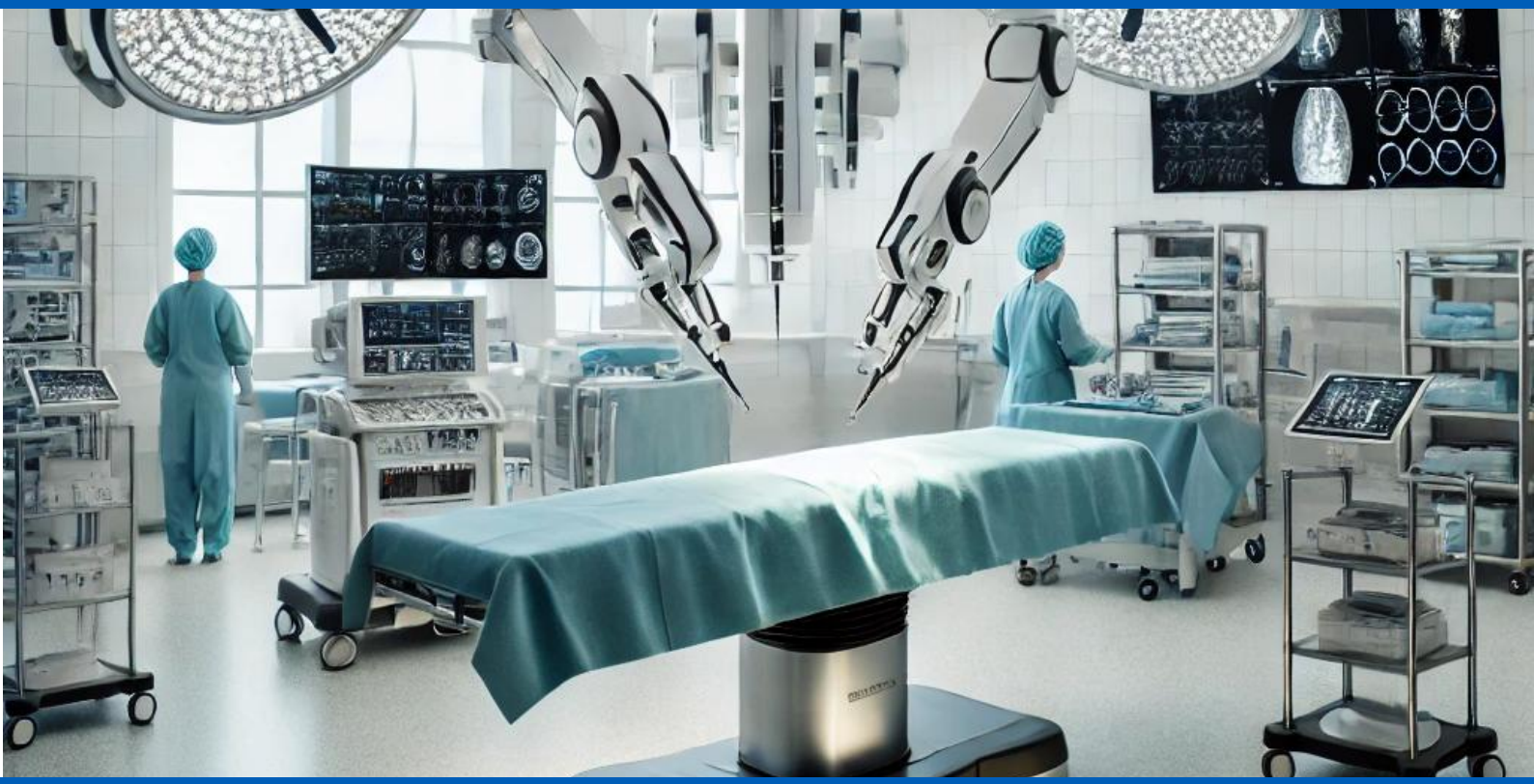
NHS England

GIRFT
GETTING IT RIGHT FIRST TIME

NHS IMPACT
Improving Patient Care Together

Implementation of robotic-assisted surgery (RAS) in England

July 2025



GIRFT is part of an aligned set of programmes within NHS England

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Foreword

Robotic-assisted surgery (RAS) is a type of surgery in which robotic technologies are used to support the work of the surgeon.

RAS has the potential to increase the provision of minimally-invasive surgery for soft-tissue procedures and allow more precision, flexibility and control in orthopaedic procedures. This could lead to faster recovery for patients and shorter hospital stays. Evidence suggests that surgeons learn RAS procedures more rapidly and there is an emerging body of clinical evidence where improved health outcomes have been demonstrated.

Although RAS has been available for over 20 years, the associated costs have impacted uptake in the NHS with its use historically limited to a small number of complex operations for cancer. However, uptake is now accelerating rapidly, with RAS being used to perform surgery in benign conditions (including orthopaedic RAS) as well as less complex higher volume procedures.

It is anticipated that a majority of 'conventional' laparoscopic procedures and an increasing proportion of orthopaedic procedures will eventually move to a RAS approach, and there is a compelling need to co-ordinate this expansion to ensure that the NHS maximises the benefits it gets for patients and the public. A key tenet will be the equitable provision of services so that all patients suitable for such surgery will get access to the benefits of RAS. Current data confirms wide variation in access to RAS.

The NHS is committed to embracing RAS and producing, in collaboration with the surgical Royal Colleges, a more structured framework for its adoption and implementation. This guide describes the objectives and principles for robust and equitable service planning and design, as well as setting standards for safe implementation, workforce training and evaluation.

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Supporting organisations

The following organisations and teams have contributed to the development of this guidance:

NHS England

Including: Getting It Right First Time, The National Elective Recovery Programme, NHS Supply Chain and The National Cancer Programme.

NICE
National Institute for Health and Care Excellence

Department of Health & Social Care

Department for Science, Innovation, & Technology

Royal College of Surgeons of England

Royal College of Physicians and Surgeons of Glasgow

The Royal College of Surgeons of Edinburgh

RCSI Royal College of Surgeons in Ireland

JCST Joint Committee on Surgical Training

ASiT The Association of Surgeons in Training

Who is this guide intended for?

This national guide is designed to inform not just clinical teams but also those individuals involved in the commissioning of local or regional services, the procurement of robotic platforms, the development of business plans for RAS, the safe implementation of RAS in provider organisations and the training of surgeons and surgical teams. Additionally, it describes the requirements for safety monitoring and evaluation.

As such, this may include:

- Provider Collaboratives
- Integrated Care Boards
- Commissioners
- Clinical networks
- Cancer Alliances
- Trust Executives (CMO, CNO, COO, FD)
- Clinical and divisional directors
- Clinical teams
- Training and education – (Heads of School, Training Programme Directors, Surgical Tutors, Clinical and Educational supervisors)

Delivery checklist

Designing and commissioning	• Coordinate a regional approach, ensuring new platforms or pathways have support from regional and system partners (e.g. Provider Collaboratives, ICBs, Cancer Alliances). • Prepare for more specialties and procedures moving to RAS in forward planning. • Trusts should plan mitigations for any impact on elective performance and cancer performance at the design stage. • Align geographical placement decisions for RAS with treatment pathways and ensure that choice of placement improves geographical equity of access. • RAS programmes must be high volume for both clinical outcomes and cost-effectiveness. • RAS programmes should be networked, allowing staff to work between sites if appropriate.
Procurement	• Trusts and systems should use the National Framework and guide available from NHS Supply Chain, which offers a compliant route to procurement and support for Robotic Medical Equipment and associated accessories. • Include a comprehensive appraisal of multiple suitable systems in business planning, considering the advantages and costs of different systems. • Trusts, ICBs and Cancer Alliances should consult NETIS (National Equipment Tracking and Inventory System) which offers key insights into the current locations of RAS platforms across the NHS. NETIS is being configured to allow activity data to be visualised by regions, providers and platforms.
Safely establishing RAS	• Approve a full business case in collaboration with regional stakeholders prior to implementation of a new RAS programme. • Establish a RAS Steering Committee, chaired by an executive SRO or senior medical leader, that reports to the relevant governance committee and has responsibility for delivery of the business case as well as ongoing delivery of RAS. • Involve regional bodies (ICBs, APCs and Cancer Alliances) in the design of RAS services. Where similar RAS programmes exist in the same region, teams should work collaboratively to support

	training as well as enabling mutual aid and flexibility in service capacity.
	• The Steering Committee and business case must consider the following aspects:
	  ○ Model of procurement and sustainability
	  ○ Scope of the programme (specialties and procedures)
	  ○ Sequencing of implementation (by specialty)
	  ○ Scheduling within the theatre template
	  ○ Proctoring arrangements (including funding)
	  ○ Commissioning implications;
	  ○ Data and safety monitoring
	  ○ Inter-dependency with other regional RAS programmes
	  ○ Workforce – a surgical first assistant is a key requirement for delivery of RAS programmes
	• Include capital replacement plans in the initial business case.
	• Present all new indications for RAS within the Trust to the steering committee.

Safely initiating RAS	• Approve the implementation plan for the novel procedure in advance through the relevant governance body within the Trust. • Describe a clear plan outlining which consultants will be training in the procedure and what proctorship arrangements are in place. • Define the exact roles and responsibilities of the proctor in advance of the programme 'going live'. • Make special arrangements for consent to inform patients of the novel aspect of the programme. • Identify suitable cases ahead of starting the programme, focusing on lower complexity procedures during the early adoption phase. • Plan for a sufficient volume of work to ensure good clinical outcomes and cost-effectiveness. • Review cases in advance by the surgeon, anaesthetist and proctor in an MDT setting. • Implement honorary contracts for all visiting members of the proctoring team. • Ensure the proctor is in attendance prior to the start of the theatre list, for the WHO safety moment, for the duration of the surgery and WHO sign-out.

	• Describe clear arrangements for the post-operative care of the patient in the early post-operative period. • Review the clinical outcomes with the proctor at a suitable interval after the surgery. • Make arrangements to monitor clinical outcomes of the RAS programme through the trust's normal audit and reporting mechanisms.
Training: Residents	• Include basic knowledge of RAS and digital literacy in undergraduate curricula. • Include RAS principles in bootcamps within the Schools of Surgery in relevant specialties. • Offer RAS training to residents in relevant surgical training programmes equitably. • In relevant specialties, incorporate RAS training aims into learning agreements, to be delivered across available platforms and with competency assessed using validated methods of assessment within the curriculum and recorded on the ISCP portfolio. • Study leave policy should reflect RAS courses on a list of discretionary courses. • Consider the specific training needs of residents in the implementation of new RAS programmes. • Give consideration at the procurement stage to training adjuncts such as dual consoles and/or simulators, where training is offered within RAS programmes. • Use high-fidelity simulation programmes to accelerate the learning curve for trainees acquiring competency in RAS.
Training: Consultants	• Document a plan for the safe deployment of RAS at institutional level via the Trust RAS Steering Committee. • RAS training comprises a technology-based training, usually delivered and assessed by platform providers. • RAS training also comprises a clinical operative training which can be delivered by clinical experts with support from industry or independent from industry. • Industry is key in supporting training, but the sequencing of consultant training should be determined by the implementation plan described in the business case.

	• Proficiency in robotics should be continuously assessed at the level of the local RAS Steering committee using logbooks and other governance data. • Documentation of competency and safety of consultants, in line with Trust RAS governance policies, must be adhered to prior to independent practice.
Training: Extended surgical team	• Surgical first assistants (SFAs) and or surgical care practitioners (SCPs), as part of the extended surgical team, are key members of the workforce for safe and efficient delivery of RAS programmes. • Provision for recruitment and training of SFAs and or SCPs should be built into the RAS business case. • The extended surgical team can enhance training opportunities for residents. • The extended team may also play a role along the patient journey to enhance the experience for patients and families.
Evaluation and safety monitoring	• Adopt the recommendations published by NICE as part of the Early Value Assessment (EVA) process ('soft-tissue' and orthopaedics). • Follow NICE's recommendations for Evidence Generation (EvGen) to support further evaluation of RAS in the NHS. • Industry providers must register their device and evidence generation plan with NICE as per the guidance. • NHSE are committed to working with key stakeholders to support a national framework for the required evidence generation in RAS.

Research needs	• Inform research plans using the Evidence Generation recommendations from NICE.
	• Data on safety, cost-effectiveness and clinical effectiveness will be required.
	• Research studies should consider other areas pertinent to expansion of RAS programmes such as:
	  ○ Implementation evaluation
	  ○ Efficient pathway designs
	  ○ Novel pathways in RAS
	  ○ PREMs and PROMs
	  ○ Workforce benefits

Introduction

Background to RAS

Robotic-assisted surgery is not new to the NHS, having been used for nearly 20 years in specific indications such as radical removal of the prostate for cancer. What has changed is the scale and speed of adoption for new indications as well as a cross-fertilisation into a wider array of surgery specialties. Whereas previously confined to major cancer surgery, RAS programmes are emerging for the treatment of benign disease, including specific RAS platforms designed for orthopaedic indications.

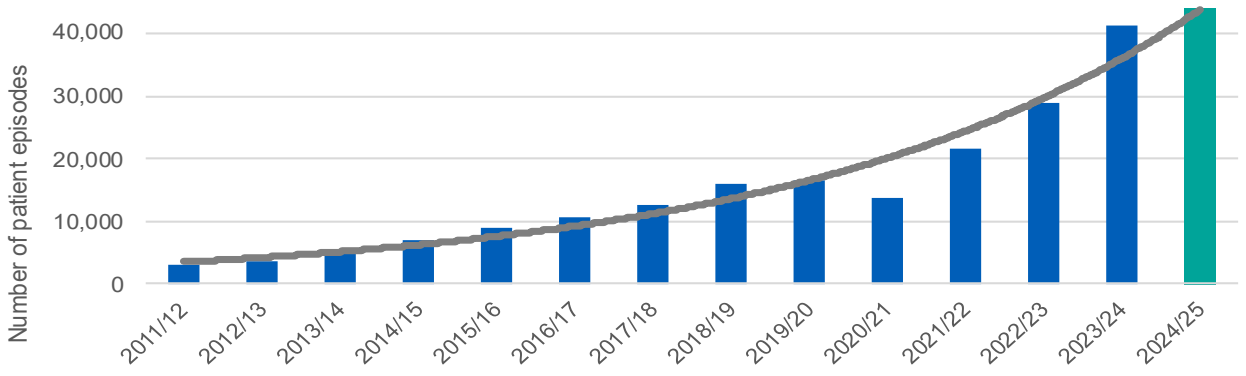
With the evolving number of providers of RAS platforms and clinical indications, the NHS needs to plan for a future that is likely to see a marked transition from 'conventional' laparoscopic surgery to one where robotic assistance in minimally-invasive surgery (MIS) for soft tissue is the norm.

To date, implementation of RAS has been uncoordinated. The challenge for the NHS in England will be co-ordinating the next phase of RAS adoption, ensuring that RAS programmes are safely implemented, cost-effective, efficient and equitably provided for patients. The previous model of RAS provision being largely restricted to cancer centres is no longer the case. It is increasingly common for new RAS programmes to be implemented in neighbouring Trusts, outside of these major centres, but the data presented below confirms that wide variation in access to RAS currently exists.

Current provision of RAS

RAS activity in England has increased from 3,099 procedures per year in 2011/12 to 41,134 by 2023/24; a more than 13-fold increase. This figure is likely to be an underestimate, due to incompleteness of coding for these procedures. Adoption is now in the exponential phase, underlining the need to have a co-ordinated plan for further expansion of RAS.

Figure 1 Number of RAS procedures in England



In 2011/12, of the 3,099 patient episodes involving a robot, only 20% were having a procedure outside of urological cancer surgery (Table 1). By 2023/24, this had increased to 49% of all procedures. In 2011/12, colorectal surgery (n = 178) and gynaecology (n = 151) were the only two other specialties conducting more than 50 procedures using a robot. By 2023/24, 11 specialties were conducting more than 50 procedures per year, with colorectal surgery accounting for 25% (n = 10,160) of all robotic procedures and gynaecology 13% (n = 5,210) of all robotic procedures. The use of RAS in orthopaedics has also seen a very rapid expansion in the last five years, from approximately 300 procedures a year in 2018/19 to over 4,000 cases 2024/25.

Table 1 Percentage of all RAS activity conducted by each specialty

Specialty	2011/12	2018/19	2023/24
Urology	80.3%	76.4%	42.2%
General surgery	5.7%	7.2%	24.7%
Gynaecology	4.9%	8.1%	12.7%
Trauma and orthopaedics	1.5%	1.5%	8.3%
Cardiothoracic surgery	0.4%	2.6%	7.2%
Ear Nose and Throat	0.0%	0.0%	1.8%

The data used for the tables and figures in this section was extracted from the Hospital Episode Statistics (HES) dataset at an episode level for the 14 financial years 2011/12 to 2024/25 (to June 30th). Robotic-assisted surgery was identified using the following codes: Y452: Approach to organ under robotic control NEC; Y743: Robotic minimal access approach to thoracic cavity; Y753: Robotic minimal access approach to abdominal cavity; Y765: Robotic assisted minimal access approach to other body cavity.

At the time of publication, there were over 140 RAS systems (excluding orthopaedic systems) installed in NHS Trusts across England based on data from the National Electronic Tracking and Inventory System (NETIS). This number is likely to be an under-estimate as not all systems will currently be captured by NETIS and, additionally, systems continue to be procured especially towards financial year end based on recent trends.

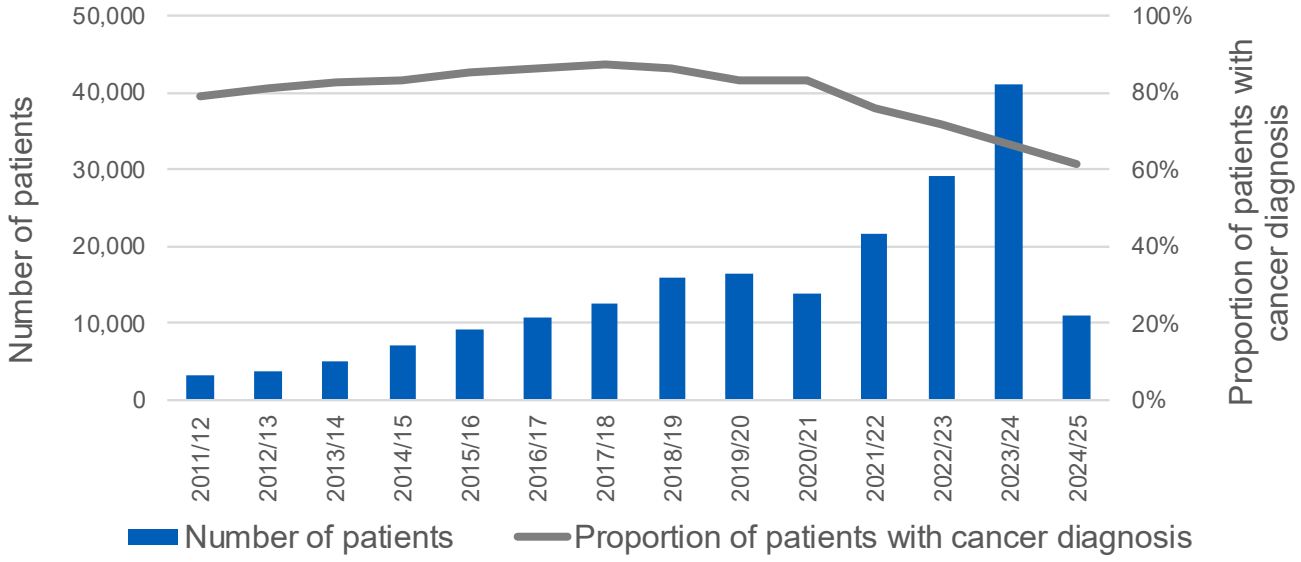
RAS activity in relation to benign and cancer surgery

The rapid expansion into new specialties has created an operational challenge for many cancer centres, given the increase in the volume of RAS activity and the need to accommodate multiple specialties on a single or limited number of RAS systems in individual sites. This has driven the adoption of RAS programmes outside of the cancer centres to not

only support the capacity challenges experienced in those centres but also to mitigate against further centralisation of MIS procedures that are currently undertaken by conventional laparoscopy in the cancer units.

Despite an overall increase in the use of RAS for cancer surgery year-on-year, the relative proportion of all robotic surgery involving patients with cancer appears to be declining markedly in the last four years (Figure 2). This is likely to reflect an increase in use of robots in specialties with lower cancer caseloads (e.g. orthopaedics) and or where benign procedures are being favoured as part of the early training of surgeons in RAS.

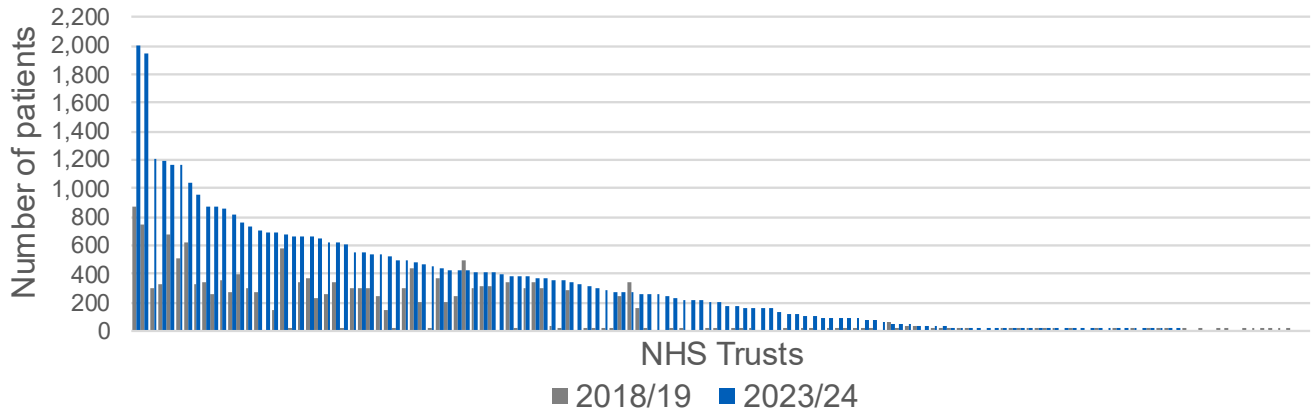
Figure 2 proportion of patients with cancer diagnosis undergoing RAS



RAS activity by Trust

There is wide variation in the total volume of RAS activity across NHS Trusts (Figure 3), with many Trusts performing relatively low volumes of RAS. For RAS programmes to be clinically effective and cost-effective, there needs to be a high volume of activity at both Trust level and surgeon level.

Figure 3 RAS activity for cancer patients by NHS Trust



RAS activity by regions and by ICB

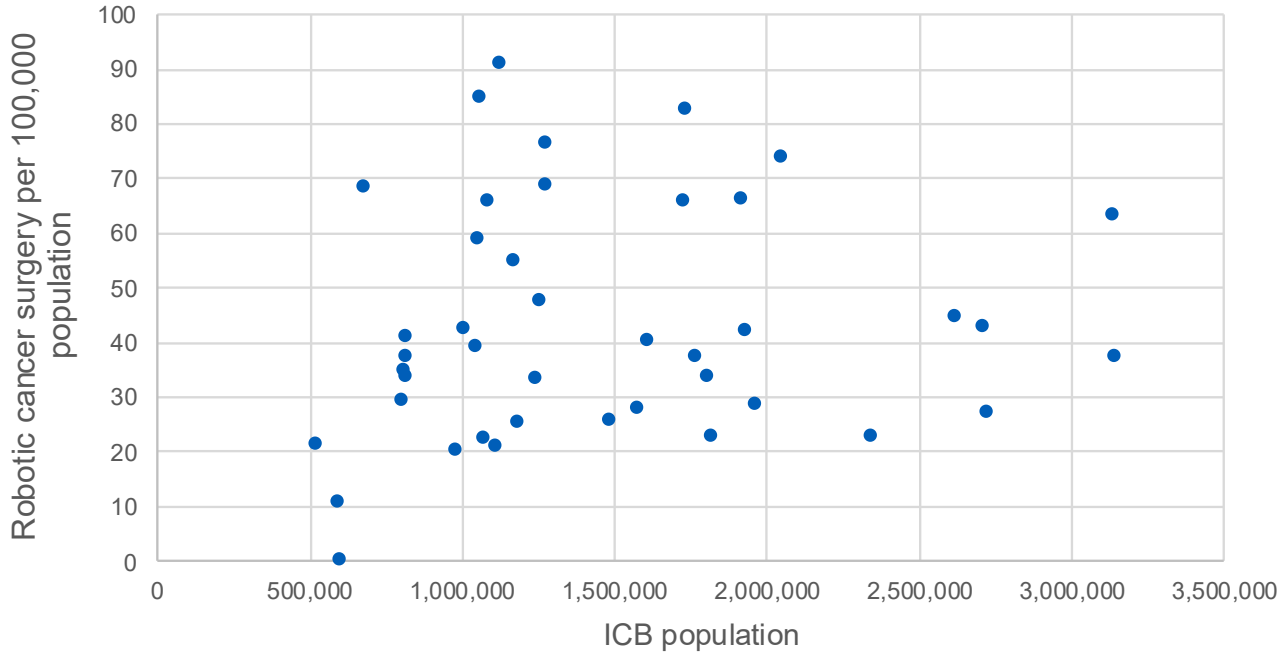
There is currently considerable variation in the use of RAS when compared across the 7 NHS regions (Table 2), though the data does not account for differences in confounders such as patient demographics, disease prevalence, referral practices or types of provider organisations.

Table 2 RAS activity for cancer patients by NHS region

Region	Number of cancer patients undergoing robotic surgery	Background population (2022/23)	Number of procedures per 100,000 population
London	5,352	10,579,509	50.6
South West	2,831	6,006,444	47.1
North East and Yorkshire	4,195	9,012,300	46.5
South East	4,358	9,569,166	45.5
East of England	3,033	7,082,155	42.8
Midlands	4,544	11,578,126	39.2
North West	2,942	7,671,121	38.4

When the data is further analysed to the level of ICBs, variation in RAS provision can again be seen with no direct correlation between ICB population and RAS utilisation (Figure 4).

Figure 4 ICB population and RAS utilisation, 2023/24



Further data collection is underway by NHS England and NICE to understand the extent of any unwarranted differences in activity related to gender, socio-economic class and deprivation index as these data will inform whether there are patient groups or parts of England where RAS provision is inequitable at present.

Benefits

Patients

RAS for soft-tissue procedures shares the benefits of other forms of MIS, including smaller incision sizes which result in better pain management control, reduced risk of infection and shorter in-hospital recovery time leading to earlier discharge home. Other benefits include better cosmesis, improved postoperative immune function and a quicker return to the workforce. There is indirect evidence that a higher proportion of patients could benefit from a MIS approach with RAS, due to a higher percentage of surgeons being able to learn and adopt this approach by comparison with conventional laparoscopy. Evidence in relation to oncological outcomes is emerging, with the majority of studies reporting equivalence and a smaller number suggesting improvements in patient outcomes.

Benefits of RAS for orthopaedic procedures include the precise positioning of implants, helping surgeons to position and align the implants in the correct position for each person. In

cavitary robotic systems, an individualised approach to surgery may improve patient satisfaction after surgery, reducing recovery time and the need for revision surgery, and similar benefits are being investigated for musculoskeletal robotic systems. RAS may also improve access to surgery for people who are at higher risk, including older people, people with a high body mass index or multimorbidity. People from Southeast Asian backgrounds may also experience greater benefits from RAS for knee replacements because of anatomical differences that can result in comparatively poorer alignment when treated with conventional surgery.

The NHS

Introducing RAS in soft-tissue procedures that are currently performed via an open approach or, increasing the penetration rate of MIS where the rates of conventional laparoscopic or thoracoscopic approaches could be improved would lead to a reduction in total bed usage. In some procedures, the use of RAS as opposed to open surgery can reduce the need for higher acuity post-operative care. Although the early adoption phase of RAS can be associated with longer operating times than the existing technique, there are examples in the NHS where high volume RAS programmes have delivered improved efficiencies in case throughput compared to open or conventional laparoscopic surgery. This is predicated on workforce and pathway redesign.

The increased precision in position of implants in orthopaedic procedures may lead to reduced demand for revision surgery. More accurate joint replacement may shorten recovery time, reducing the need for follow-up appointments with GPs, surgeons and physiotherapists, and the prescription of pain management medicines.

Surgical Workforce

RAS offers technical advantages in surgery, including better visualisation with increased magnification of the surgical field and stereoscopic views, elimination of hand tremor by use of the robotic arms and instruments to both visualise and perform the procedure (under the surgeon’s control) and improved manoeuvring because of the ‘robotic wrist’. The kinematics are also improved where external movements of the surgeon’s hands can be scaled down and transformed to limited internal movements of the robotic instruments. This leads to improved ergonomics allowing the surgeon to perform complex technical tasks within a confined space, improving access to challenging areas, such as the narrow pelvis, thereby allowing the surgeon to work in an ergonomic environment with less stress and fatigue.

In soft-tissue procedures, these technical advantages are in addition to the existing advantages of conventional laparoscopic surgery.

RAS has also been associated with reduced rates of musculoskeletal injuries. Self-reported injuries, fatigue and pain have been reported ranging from 20%-80% amongst surgeons performing laparoscopic surgery. By contrast, in RAS, studies have demonstrated reduced musculoskeletal fatigue (particularly in upper and lower limb muscles) which could, in time, have benefit for surgeon longevity in the workplace. Some studies have also demonstrated reduced cognitive load amongst surgeons performing robotic procedures compared with a laparoscopic approach. RAS can introduce other challenges, for example surgeons need to have robust situational awareness as they are away from the patient.

Challenges

A major barrier to more widespread adoption of RAS for many organisations is the capital and revenue cost of establishing and running a RAS programme. In this regard, programmes have to be high volume and be capable of efficient turnaround times, with minimal downtime for the systems. In the current absence of comprehensive commissioning guidance for individual procedures and a disparity between existing tariff and the additional costs of RAS, it is recognised that it can be challenging for organisations to create realistic business cases during this transition period.

From a technical perspective, a lack of haptic feedback and a perceived increased operating time due to the complex setup and docking procedures are considerations. Furthermore, the adoption of robotic surgery has been criticised due to the lack of standardised curricula and quality assurance procedures. These issues are discussed further below in relation to providing the necessary guidance to quality assure training, implementation and workforce requirements. Scalability and equity of access to RAS are intimately related to these aspects as it is increasingly a challenge to provide training and mentorship at a pace that matches the procurement of RAS systems.

1. Designing and commissioning RAS programmes

Key quality actions

- Coordinate a regional approach, ensuring new platforms or pathways have support from regional and system partners (e.g. Provider Collaboratives, ICBs, Cancer Alliances).
- Prepare for more specialties and procedures moving to RAS in forward planning.
- Trusts should plan mitigations for any impact on elective performance and cancer performance at the design stage.
- Align geographical placement decisions for RAS with treatment pathways and ensure that choice of placement improves geographical equity of access.
- RAS programmes must be high volume for both clinical outcomes and cost-effectiveness.
- RAS programmes should be networked, allowing staff to work between sites if appropriate.

At the current time, nearly all new RAS programmes will have network or regional considerations that must be adequately addressed by Trusts in relation to service design, training, implementation, redesign of patient flows and the potential unintended impacts on existing RAS programmes, such as destabilising a neighbouring programme.

Plans must be endorsed by the relevant stakeholders and there should be a suitable form of system governance that supports strategic decision-making, as well as allowing all system partners to both query and understand the vision for the service. For example, a Provider Collaborative clinical network can be the vehicle to oversee the engagement with service leads, medical and clinical professionals, business managers, all partner Trusts, patient groups, the Cancer Alliance (when appropriate) and the ICB.

Active involvement of regional bodies is essential to ensure that geographical equity is maintained and that robotic systems are sited appropriately for patient referral pathways. Multiple systems on a single site may not be appropriate unless the region has constructed a model that also aligns workforce, patient travel, surgical access, diagnostics and pre- and post-operative capacity. These are given as examples of confounding variables, but the list is not exhaustive.

Systems and Trusts need to factor in that RAS will be ‘cross-cutting’ across multiple specialities and range from complex procedures that need high acuity settings through to lower complexity higher volume procedures that are better suited to ‘cold’ site or HVLC working. Not all procedures should be provided at all sites but rather they should be networked.

Surgeons and the extended surgical team are likely to be required to work across sites in a more networked fashion, conceptually visualised as one clinical service delivered by one team across multiple sites and providers. This includes networking across multiple robotic platforms as it is likely that robotic programmes will increasingly have a number of different platforms in use within the network. This contrasts the majority of existing models and providers should therefore work collaboratively to facilitate new ways of working and support 'passporting' of staff across the network. Remote mentoring and 'tele-proctoring' can support this multi-site approach to RAS.

Programmes must be designed to offer a high volume of surgery if they are to be cost-effective and this typically means ensuring that they are being fully utilised on all working days Three-session days can work well for major RAS procedures to further improve utilisation. Theatre allocations should be configured to avoid the situation whereby a RAS system is 'idle' whilst other surgeries take place. This requires cross-specialty collaboration and a flexible theatre programme.

Ahead of implementation, there needs to be a clear system vision supported by a coherent clinical strategy that ensures service development can be undertaken whilst still delivering constitutional performance targets. There will be a short-term consequence on routine elective activity, the effects of which must be mitigated across the system by having clear sight of inter-dependencies and a continuous focus on optimal service organisation more broadly (for example, 'hot' and 'cold' sites, efficient theatre utilisation and right procedure, right place).

Proposals should be developed with reference to population need, demand pressure and consideration of optimal service configuration in line with the current evidence base and best practice principles.

Given that cancer has been a longstanding area of robotic practice, the evidence base is currently much stronger. In this context, any further investment in the expansion of robotic capacity to supplement wider growth in elective treatment capacity is likely to have the greatest potential benefit for cancer treatment at this stage. However, robotic surgery for benign disease is increasingly recognised as a growing area and, given that most platforms will not operate in isolation, the ability to maintain existing cancer surgery pathways should be evaluated against the need to expand programmes for wider indications.

Stakeholder input

At a minimum, stakeholders should include:

- Regional medical leadership and Provider Collaboratives, including leads for elective care and cancer, when a service has implications beyond the provider Trust (the majority of programmes)
- Lead ICB commissioners
- Senior representation from NHS Trusts who have relevant responsibilities for the population within the proposed geography
- Service leads – clinical and managerial
- Senior representation from the Cancer Alliance, where appropriate
- Deanery representation
- Where pathway redesign is proposed, consultation with patient groups should be considered

Minimum design principles

Replacement and expansion of robotic equipment has implications for upfront and ongoing costs due to maintenance, workforce training and consumables. It is therefore important that minimum design principles are followed to maximise the benefit of this investment. Local and national data as well as clinical evidence should be used to inform decisions about equipment purchase and placement with consideration given to the interaction of any new or replacement equipment alongside established capacity. Most RAS programmes, to date, have centred around the delivery of cancer surgery. The benefits in this field, particularly for cancers anatomically located in the pelvis is well described. There will be an increased demand for robotic surgery in benign disease. This may be as part of a training pathway, where simpler cases form the basis of a stepwise programme to RAS competence or where evidence clearly demonstrates the benefits of RAS in benign disease. Plans should include an assessment of how proposed investment would:

- Maintain capacity and resilience within pathways where there is the strongest evidence of benefit.
- Coordinate a regional approach, by discussing new platforms or pathways and seeking approval from regional and system partners (e.g. ICBs, cancer alliances).
- Contribute to Elective Reform Plan performance objectives in priority pathways.
- Support optimal utilisation in line with established benchmarks.
- Align with plans for relevant workforce, training and development as set out in this guidance.
- Conform to relevant standards and any subsequent accreditation frameworks to establish conformity with best practice design principles.

2. Procurement

Key quality actions

- Trusts and systems should use the National Framework and guide available from NHS Supply Chain, which offers a compliant route to procurement and support for Robotic Medical Equipment and associated accessories.
- Include a comprehensive appraisal of multiple suitable systems in business planning, considering the advantages and costs of different systems.
- Trusts, ICBs and Cancer Alliances should consult NETIS (National Equipment Tracking and Inventory System) which offers key insights into the current locations of RAS platforms across the NHS. NETIS is being configured to allow activity data to be visualised by regions, providers and platforms.

RAS system choice considerations:

- Purchase cost, service contracts and revenue model;
- Volumes of activity and cost-effectiveness;
- Environmental sustainability;
- Portability;
- Cross-specialty capabilities;
- Flexibility to upgrade system specification;
- Sterilisation requirements;
- Use alongside multiple systems in larger programmes;
- 'Closed' systems that can only be used with implants made by the same supplier.

Choice of robotic platform

There are now a variety of robotic platforms available in the United Kingdom capable of delivering RAS programmes. The number of manufacturers and choice of robotic devices is likely to increase, alongside the increasing adoption of RAS.

Different RAS systems offer distinct advantages and these should be taken into consideration at the procurement and design stage of the programme (see RAS system choice considerations above). Trusts or networks may deploy more than one type of robotic platform in order to deliver the full range of procedures outlined in their business planning and are encouraged to appraise the full range of platforms available.

It is essential that organisations undertake a comprehensive appraisal of all suitable systems must form part of any business planning, in order that the most appropriate device or devices

are procured. In larger programmes, it is likely that multiple different platforms will be in use, again matched to the requirements of the individual RAS pathways.

Volumes of activity will have a bearing on contracting and procurement discussions, with higher volume programmes usually being more cost-effective in relation to business planning. Environmental sustainability will need to feature as a more prominent considerations for both the manufacturer and the provider. The NHS is committed to reaching carbon net zero and improvements will be required in relation to robotic-assisted surgery to support this ambition.

National Framework and guide - Robotic Medical Equipment, Associated Accessories

NHS Supply Chain manage the National Framework for Robotic Medical Equipment, Associated Accessories. The Framework covers the following Robotic Medical Equipment:

- Minimally Invasive Surgical Robots
- Spinal and Neurological Robots
- Freestanding Robotic Arms

RAS in orthopaedics is covered under NHS Supply Chain Total Orthopaedic Solutions. A framework customer engagement guide is available.

NHS Supply Chain offer support on the procurement process with a standard set of documentation and Category Management expertise for the procurement.

Please contact Diagnostics@supplychain.nhs.uk for further information and to review the current systems and suppliers available.

NETIS (National Equipment Tracking and Inventory System)

NHS Supply Chain are working in collaboration with the Department of Health and Social Care (DHSC) and other key government bodies in the design, build and implementation of a National Equipment Tracking and Inventory System (NETIS). NETIS has been adopted as part of the DHSC Medtech Strategy and has been cited in multiple national initiatives as a project and platform that could support transformation across the NHS as part of the NHS Long term plan.

NETIS is a platform that will consolidate multiple data sets from various organisations to give a single coherent view of medical assets across the NHS landscape. In turn, this will support with:

- Enhanced system resilience
- Improved management and efficiency of medical assets
- Better device choice
- Improved utilisation and enhanced system coherency – The Right Product, Right Place and at the Right Price

Improving visibility of our assets and how they are being used will support in generating value to the NHS through cost avoidance and optimal pricing through data driven procurement, improved resilience and to encourage asset sharing across the ICS landscape.

NETIS will amalgamate several datasets to provide a national picture of Medical Equipment Assets across the UK health sector. This dataset, shown in a visual and analytical format can be used by users for enhanced capital planning, equipment replacement, to underpin resilience (both local and national) and to ensure up to date technology is available across the UK to support patient pathway and throughput. Additionally, the system will support with identifying inequalities and support pro-active investment to reduce this inequality.

Utilising NETIS for Robotic Assisted Surgery and On-going Business Intelligence

The NETIS system contains asset data relating to the install base of Surgical Robotic equipment in use across the NHS system. This data is fluid and is refreshed as and when assets are replaced or more equipment is provided into the system – matching this asset data to RAS procedure volumes at trust and site level allows the team to understand where there is a requirement to invest in additional equipment, where equipment may be over utilised or not being used in its most effective manner, or where there may be spare capacity which may be utilised to support the backlog of RAS requirements within the wider ICB or network.

The NETIS team have committed to building a live business intelligence (BI) dashboard which will allow users to track RAS volume against assets across NHS acute trusts. The power of this visualisation will allow users to quickly determine where capacity or throughput is not aligned to national averages or targets which in turn will aid value added and data driven decisions across a range of stakeholders to drive improvement and output.

3. Essential Steps to establish and safely implement RAS programmes in Trusts

Key steps to establish RAS programmes in Trusts

- Approve a full business case in collaboration with regional stakeholders prior to implementation of a new RAS programme.
- Establish a RAS Steering committee, chaired by an executive SRO or senior medical leader, that reports to the relevant governance committee and has responsibility for delivery of the business case as well as ongoing delivery of RAS.
- Involve regional bodies (ICBs, APCs and Cancer Alliances) in the design of RAS services. Where similar RAS programmes exist in the same region, teams should work collaboratively to support training as well as enabling mutual aid and flexibility in service capacity.
- The Steering Committee and business case must consider the following aspects:
  - Model of procurement and sustainability
  - Scope of the programme (specialties and procedures)
  - Sequencing of implementation (by specialty)
  - Scheduling within the theatre template
  - Proctoring arrangements (including funding)
  - Commissioning implications
  - Data and safety monitoring
  - Inter-dependency with other regional RAS programmes
- Workforce – a surgical first assistant is a key requirement for delivery of RAS programmes.
- Include capital replacement plans in the initial business case.
- Present all new indications for RAS within the Trust to the steering committee.

Existing professional guidance

The Royal Colleges of Surgeons of England (RCSEng) and Edinburgh (RCSEd) have established robotic expert advisory groups to consider issues pertinent to the safe implementation of robotic assisted surgery (RAS) programmes. Both Colleges have produced documents which are practical tool kits for individual hospitals to use when setting up robotic surgical services. The Royal College of Surgeons of Ireland (RCSI) is soon to publish their latest guide. These documents contain comprehensive recommendations covering training and clinical governance relevant to all surgical specialties. The overall responsibility for clinical governance of a robotic programme lies with individual NHS trusts.

RCS England guide to RAS >

RCS of Edinburgh guide to RAS >

RCS of Ireland guide to RAS >

Governance and management principles for safely establishing the programme

Prior to starting a robotic programme, a Trust should set up a RAS steering and governance committee. The RAS steering committee should include senior representatives from the Trust Board, the Finance Department, surgery, anaesthetics, nursing, sterilisation, theatres, estates and medical education. Relevant service leads and business managers will need to be included from those teams that will be undertaking the new procedures.

The steering committee should report into the existing Trust governance structures and assume responsibility for the delivery of a comprehensive business case as well as subsequently becoming the oversight group for the ongoing delivery and monitoring of the RAS programme. Members of the steering group must declare any conflicts of interest in the normal manner.

It is the role of the steering committee to consider the following key aspects of the programme:

- External engagement with regional and system stakeholders
- Commissioning considerations
- Procurement approach
- Scope of the programme (specialties and procedures)
- Clear sequencing of implementation by specialty and by surgeon
- Workforce considerations (including surgical first assistants)
- Considerations in theatre scheduling and capacity
- Proctoring and training
- Governance and safety monitoring

As well as focusing on defining the surgical specialties which will adopt RAS at the start, it can be equally important at the outset to state clearly which specialties are not to form part of the initial RAS strategy to prevent unplanned ‘mission creep’. New requests to expand into other surgical areas should always be routed through the RAS steering committee. This is to ensure full oversight of RAS demand and capacity as well as performing due diligence in keeping regional and system partners informed of any future plans that would have inter-dependencies with other providers.

The steering group should define the requirements for the location and type of robot(s), the theatre team and timetabling of access with a clear strategy for case numbers and procedures to be delivered in an annual plan. As mentioned previously, a RAS programme

should only be implemented where there is sufficient evidence of case volumes to ensure it is maximally deployed and that the fixed costs, such as capital purchase and annual servicing contracts, are proportionately minimised per case. The steering group will identify appropriate case mixes in individual specialties, independent of comment or advice from industry, to avoid conflict of interest or inefficient use of NHS resources.

Governance and management principles for safely initiating the programme

Key considerations for safely initiating the RAS programme

- Approve the implementation plan for the novel procedure in advance through the relevant governance body within the Trust.
- Describe a clear plan outlining which consultants will be training in the procedure and what proctorship arrangements are in place.
- Define the exact roles and responsibilities of the proctor in advance of the programme going live.
- Make special arrangements for consent to inform patients of the novel aspect of the programme.
- Identify suitable cases ahead of starting the programme, focusing on lower complexity procedures during the early adoption phase. Plan for a sufficient volume of work to ensure good clinical outcomes and cost-effectiveness.
- Review cases in advance by the surgeon and proctor in an MDT setting.
- Implement honorary contracts for all visiting members of the proctoring team.
- Ensure the proctor is in attendance prior to the start of the theatre list, for the WHO safety moment, for the duration of the surgery and WHO sign-out.
- Describe clear arrangements for the post-operative care of the patient in the early post-operative period.
- Review the clinical outcomes with the proctor at a suitable interval after the surgery.
- Make arrangements to monitor clinical outcomes of the RAS programme through the trust's normal audit and reporting mechanisms.

Principles of RAS Training.

As with the adoption of any new surgical technology, training is required not only for the surgeon but also as appropriate for the anaesthetic team, surgical first assistant and the wider theatre team. Funding for an appropriate level of training and clarity about the method of training and assessment must be established by the RAS steering and governance committees in the trust in advance of commencement of the programme.

A distinction needs to be made between the responsibilities of the Trust and industry, with the latter providing technology-based training as opposed to clinical training. As part of the MHRA requirements, industry is responsible for ensuring that the equipment provided can be deployed and used safely by the surgical team (see box below). Clinical training in specific operative procedures then becomes the domain of experienced surgeons who have the necessary proctoring skills. To date a large proportion of clinical training has been supported by industry, often incorporated into the initial contract on purchasing a device. This can be challenging with the wider roll-out of RAS programmes and the development of increasing numbers of different robotic companies, with differing technology.

In principle, industry should not be involved in the selection of clinicians for training in particular procedures; this should be approved in advance by the relevant governance structure in the trust. Neither trusts nor industry are mandated to sign off on a clinician's operative competency.

Responsibility for the safe delivery of surgery lies with the individual surgeon, in line with GMC good practice guidelines and supported by the Trust's governance structure. While not being established accrediting bodies, specialist associations potentially have a significant role to play in the development of RAS, due to their detailed knowledge of high-volume well-run RAS services nationally.

Technology training for device specific training should include:

- Safe port placement;
- Docking and undocking of the system;
- Camera control;
- Retraction and arm control;
- Instrument manipulation;
- Energy activation, suturing;
- Instrument insertion and exchange;
- System manipulation and troubleshooting.

Safety in the early stages of a robotic programme.

The implementation plan and arrangements for training should be approved in advance by the relevant governance structure in the Trust. The plan should clearly describe which consultants will be training in the relevant procedure and what proctorship arrangements are in place. It is usually beneficial to allocate a number of consecutive lists for the initial start-up of the RAS programme and reduce the workload accordingly to allow adequate time for familiarisation with the new technique.

The exact roles and responsibilities of the proctor should be clearly agreed and recorded in advance, with provision of honorary contracts and formal HR sign-off at the Trust. There should be an MDT process involving the proctor to ensure that suitable cases are selected for the initial stages of the programme. These cases should be of lower complexity in relation to both the patient and disease characteristics. Special arrangements for consent should be in place and best practice would also involve the opportunity for the proctor to take part in the consent process with the patients. The proctor should be present ahead of the operating list starting to participate in the WHO checklist and remain in the case until the WHO sign-out. There should be clearly described arrangements for providing post-operative care including out-of-hours cover for any post-operative problems.

It is clear that future training frameworks are needed and that such a framework takes account of the level of training required for individual surgeons using RAS. There needs to be clear, well-defined language and responsibilities for each different role, The level of support may well vary based on both the surgeon's and the team's prior experience. In addition to proctors, preceptors, mentors, and medical science liaisons (highly trained technical experts in the robot) can be considered within this framework. As RAS becomes more widely adopted, this framework will be central to reducing the cost of training whilst expanding access to the right level of training and ultimately moving to a 'business as usual' situation.

All cases should be recorded in a database at surgeon and Trust level and form part of the regular governance group discussion of robotic cases, a more in-depth forum than a standard morbidity and mortality forum, to facilitate learning and adaption within the program. Feedback should also be provided to the proctor.

Patient information and consent.

The GMC principles of consent should be applied to all patients, including those having RAS. This includes the purpose and expected benefit of the treatment, what it involves, the likelihood of success, the material risks of the procedure and the alternative options. The

consent process should include information about the novelty of the program within a Trust and the experience in both RAS and other approaches of the surgeon performing the operation. There should be detail about the presence or absence of a proctor and detail of where the surgeon is on the learning curve.

The learning curve refers to the increased risks to patients during the time in which a surgeon or surgical team gain competency in a new procedure. It applies where the original innovator is gaining experience in the new technique but also where the technique is performed in different hospitals by other surgeons. Clear and honest communication is essential with patients and their families.

4. Training in RAS

4.1 Training Consultants and Specialist Doctors

Current state

- The current consultant training model is 'ad-hoc' and lacks national or regional coordination.
- Consultants undertaking early adoption of novel RAS procedures often rely on international proctoring.
- The next phase of adoption typically relies on consultant-to-consultant upskilling but there is minimal guidance on how competency-based training is delivered or assessed.
- Terminology is often inappropriately applied in relation to training, proctoring, mentoring and assessment of competence.
- Industry 'sign-off' predominates at present rather than an objective centralised model
- Training is predominantly platform-specific rather than generic.
- There is an absence of consistent quality standards for achieving competency.
- Expert opinion describes a current scenario where marked variation exists in relation to the rigour in which training and mentoring is delivered.
- It is not always clear where the roles and responsibilities of a proctor begin and end in relation to delivery of surgical care and patient safety.

There has been a widespread but poorly coordinated uptake of RAS by consultant surgeons across the NHS, not least because there has been no prior agreed national approach to adoption and implementation of RAS. Most consultant training has been delivered by industry providers of RAS systems using a combination of online learning, 'dry-lab' (simulation), 'wet-lab' (animal and cadaveric models) and, ultimately, proctoring during live operating.

This training has largely been funded within Trust/Industry contracts when RAS platforms are purchased and is thus limited to the specific manufacturer, often with specific requirements relating to the operative cases and associated consumables.

As more consultants start robotic practice, the quality of training and assessment of competence has the potential to be less robust with an unintended impact on patient safety if the necessary standards and governance measures are not clearly followed and maintained.

Key quality actions

- Document a plan for the safe deployment of RAS at institutional level via the Trust RAS Steering committee.
- RAS training comprises a technology-based training, usually delivered and assessed by platform providers.
- RAS training also comprises a clinical operative training which can be delivered by clinical experts with support from industry or independent from industry.
- Industry is key in supporting training, but the sequencing of consultant training should be determined by the implementation plan described in the business case.
- Proficiency in robotics should be continuously assessed at the level of the local RAS Steering Committee using logbooks and other governance data.
- Documentation of competency and safety of consultants, in line with Trust RAS governance policies, must be adhered to prior to independent practice.

Standardising Consultant Training in RAS surgery

The preferred model of specialty RAS training might include independent external assessment of a consultant's individual skill set, aligned to core criteria and accreditation, but this is not yet practicable as neither specialty associations nor the Royal Colleges are established accrediting bodies for RAS. Two broad models of training in RAS have emerged:

- External training model: In newly established RAS programmes, it is common for training to be provided externally, requiring consultants and theatre team members to spend time away from the Trust. In-reach proctoring is required with an explicit agreement by colleagues within units that suitable cases will be allocated to the training consultant. There are also implications for the proctor's availability for NHS practice.
- Peer-to-peer model: In specialties where RAS becomes 'business as usual', a model of peer-to-peer training is becoming accepted within established programs with clear training structures and governance processes.

Where RAS use is being proposed for an innovative procedure, the local RAS steering committee should clearly document that it acknowledges the governance limitations in this case but has put in place steps to ensure patient safety.

The peer-to-peer model relies less on industry and allows individual Trusts and regional services to establish strategies ‘in-house’ for expansion of their robotic programmes. However, it is essential that there is no dilution of standard or objectivity when assessing competence between colleagues.

Training in specific operative procedures becomes the domain of experienced surgeons who have the necessary proctoring skills, though industry providers will often support the initial costs incurred in providing this proctorship to new RAS programmes.

Considerations for proctorship

There remains a shortage of RAS proctors in specialties that are relatively new to RAS and this can be a barrier preventing the delivery of equitable training or indeed scale up of services that would benefit from moving to a RAS-based platform. There is also a potential impact on service delivery for those Trusts that release proctors to support training. There is a large variation in available proctors across the surgical subspecialities, with a large number in established specialties such as urology but many fewer in emerging surgical subspecialties such as UGI, HPB, ENT, OMFS, thoracic and cardiac surgery.

A sustainable solution to robotic proctoring will be essential for scaling RAS adoption, but it is a complex field and not without risk to the proctor due to gaps in training frameworks and support systems. The urgent development of standardised guidelines and professional support structures is required to ensure consistency, quality, and safety in robotic surgical training, to protect not only the proctor and novice surgeon but, most importantly, the patient. Consideration should be given to a national network of recognised NHS proctors to train their peers and standards should be set to describe the necessary quality assurances and professional support needed during this transition period. There should be a recognised method of competency ‘sign-off’ that is led by the NHS rather than industry.

As part of the normal appraisal arrangements in their host institution. proctors must follow existing professional guidance – for example, declaring any resultant income or potential conflicts of interest that arise in relation to their proctoring role. This should also form part of annual appraisal. Proctoring fees must comply with existing guidance on the level of reimbursement, in relation to ‘fair market value’ as part of professional standards.

Future considerations

- There should be a standardised and coordinated approach to the delivery of training for consultants and specialists.
- The roles and responsibilities of a proctor need to be clearly defined.
- The boundary between industry-led training and procedural training needs to be clearly defined.
- The Royal Colleges of Surgery and Surgical Specialty Associations (SSAs) have a key role to play in determining aspects such as case volumes of surgical activity that will support delivery of high-quality clinical outcomes
- The NHS should not rely solely on industry 'sign-off' for competency in RAS and there should be consideration of a process of accreditation for proctors that is co-designed with the Royal Colleges, SSAs and NHS England.
- In time, bespoke arrangements for accreditation could be replaced by national audits which aim to maintain standards as RAS becomes embedded in day-to-day surgical practice.

4.2 Training Residents

Current state

- There is a clear demand for RAS training from residents.
- Specialty curricula do not currently make specific recommendations on RAS training.
- Access to RAS training for residents is currently inequitable and predicated on ad-hoc local availability.
- Surgical curricula may be reviewed and altered in line with developments in technology, healthcare delivery and societal needs.
- The demand for RAS training in residents' programmes will increase.
- Training opportunities are provided by multiple industry and specialist surgical society bodies but access to these is currently uncoordinated and not consistently linked to the training needs of individual residents.

There is a significant unmet need for appropriately qualified surgeons to perform RAS. As RAS scales up across the NHS, there is a need to adapt training for residents in line with the changes in clinical practice to ensure that they are adequately trained to deliver the roles and fulfil the responsibilities of a newly appointed consultant.

Given the developments in RAS and the limited number of procedures that may benefit from its adoption, it is neither feasible or realistic for all surgical trainees to gain competency in RAS in their chosen subspecialty. Training in elements of RAS surgery is likely to be

delivered in the later phase of subspecialty training to a cohort of clinicians who display the aptitude and haptic skills to learn the techniques.

The method for reviewing and revising surgical curricula is described in detail in Appendix 1, along with a summary statement from the specialty advisory committees (SACs) within surgery and a statement from the Association of Surgeons in Training (ASiT).

NHS England's RAS Steering Committee is working with the Joint Committee on Surgical Training (JCST), the SACs, the ASiT, the Heads of Schools of Surgery (CoPSS) and NHS England Workforce, Training and Education to ensure a forward-looking and coordinated approach to delivering realistic, fair and equitable training in RAS.

It is recognised that training needs will differ according to the phase of surgical training. In relevant specialties, early broad exposure to RAS principles will be required for the majority of specialty residents. However, it will only be a smaller percentage of those residents that will need to enter later phase training in RAS or pursue fellowship training, where their sub-specialist interest incorporates RAS. In the later years of training, this will require a more bespoke approach to RAS training that will be informed by the individual learning agreements between a trainee, their Training Programme Director (TPD) and Assigned Educational Supervisor (AES). The learning agreement should align with the specialist interest and curricular requirement of the individual resident. As the scale of RAS increases, curricular requirements, training opportunities and funding for training will need to reflect the changes in service delivery in the same manner as other areas of changing surgical practice. The mechanism for designing these changes is provided in detail in Appendix 1.

Surgical simulation and immersive technology in surgical training

Surgical training has traditionally relied on apprenticeship models which in the current climate has faced increased challenges including reduced training opportunities secondary to increased service provisions; variability in training experiences and reduced working hours secondary to the EWTD (European Working Time Directive). High fidelity simulation using immersive technology such as VR (virtual reality) and AR (augmented reality) in addition to digital simulators have offered diverse training modalities to deliver training outside of the operating room. Simulation training offers safe training of surgical skills in addition to the practical knowledge needed to perform surgical procedures.

The current RAS industry providers have high fidelity simulation programmes which are a mandatory part of their training pathways. Industry have recommended competency is achieved in their simulation training to proceed to the next stage of training including lab-

based models and live operating. Future RAS training should use high-fidelity simulation programmes to accelerate the learning curve for trainees' acquiring competency in RAS.

Key quality actions

- Include basic knowledge of RAS and digital literacy in undergraduate curricula.
- Include RAS principles in bootcamps within the Schools of Surgery.
- Offer RAS training to residents in relevant surgical training programmes equitably.
- In relevant specialties, incorporate RAS training aims into learning agreements, to be delivered across available platforms and with competency assessed using validated methods of assessment within the curriculum and recorded on the ISCP portfolio.
- Study leave policy should reflect RAS courses on a list of discretionary courses.
- Consider the specific training needs of residents in the implementation of new RAS programmes.
- Give consideration at the procurement stage to training adjuncts such as dual consoles and/or simulators, where training is offered within RAS programmes.
- Use high-fidelity simulation programmes to accelerate the learning curve for trainees acquiring competency in RAS.

Future considerations

- The curricula for specialty training should be reviewed, where appropriate, to incorporate RAS.
- Consideration should be given to a regional hubs model for RAS training.
- There should be a national inventory of RAS training courses and facilities.
- Industry providers should work collaboratively within the NHS to support a coordinated approach to training.
- Access to training opportunities should be determined by the TPD in collaboration with Trusts.

4.3 Training the Extended Surgical Team (EST)

Current state

- There is wide variation in the use of the extended team in RAS.
- Experience and competencies are largely restricted to planned elective procedures as opposed to emergency procedures.
- Established programmes commonly use an extended team member as a bedside assistant.
- Resident doctor groups have expressed concerns about potential loss of operative opportunities.

To support the anticipated further expansion of RAS, team structures and roles will need to be adapted with training of the wider surgical team being a key requirement. Trusts will need to ensure that teams' skills and knowledge are enhanced as a higher percentage of theatre teams are exposed to RAS. Additionally, it is anticipated that the extended RAS team will increasingly feature in the management of post-operative complications as well as acute surgical care.

As the surgeon is remote to the operative field, it is essential to have surgical care practitioners (SCPs) or surgical first-assistants (SFA) as part of the RAS programme, as determined by the nature of the programme itself. The difference between a SCP and a SFA lies in their scope of practice, level of training and responsibilities within the surgical team. Recruitment and training for SCPs and / or SFAs should be included in RAS business cases. They are crucial to the efficient and safe delivery of the programme and their role extends across the patient pathway.

During surgery, they will be required to take an active role in the procedure by assisting the surgeon and, where appropriately trained, operating surgical devices such as staplers and energy devices. However, differences must be noted in the scope of practice between SFAs and SCPs. The latter may undertake aspects of the procedures with supervision whereas the SFA role is limited to assisting during the procedure.

New programmes should take into account what level of expertise is required to support the delivery of the various robotic pathways and ensure that the extended team have the necessary scope of practice and competencies to meet these requirements. SFAs and SCPs are typically expert at trouble-shooting problems with the RAS platform and they can play a pivotal role in maintaining short turnaround times between cases by preparing the robot and assisting patient positioning.

The role of dedicated bedside assistant may also form part of the early stages of training of a surgeon, irrespective of grade, prior to training on the console. This would be done with supervision and should not be a substitute for dedicated SFAs / SCPs within the programme.

Key quality actions

- Surgical first assistants (SFAs) or Surgical Care Practitioners (SCPs), as part of the extended surgical team, are key members of the workforce for safe and efficient delivery of RAS programmes.
- Provision for recruitment and training of SFAs and SCPs should be built into the RAS business case.
- The extended surgical team can enhance training opportunities for residents.
- The extended team may also play a role along the patient journey to enhance the

5. Evaluation and safety monitoring

Key quality actions

- Adopt the recommendations published by NICE as part of the Early Value Assessment (EVA) process ('soft-tissue' and orthopaedics).
- Follow NICE's recommendations for Evidence Generation (EvGen) to support further evaluation of RAS in the NHS.
- Industry providers must register their device and evidence generation plan with NICE as per the guidance.
- NHSE are committed to working with key stakeholders to support a national framework for the required evidence generation in RAS.

The adoption of RAS as a surgical approach across the NHS has been moving at a pace that precedes the acquisition of formal evidence for its clinical benefit and cost-effectiveness for most procedures.

The reasons for rapid adoption almost certainly relate to an increase in access to RAS platforms and the shorter learning curve and improved dexterity for surgeons on these systems, compared to conventional laparoscopy. However, the clinical safety and the affordability of scaling up RAS should be actively evaluated.

In this regard, NHS England asked NICE to prioritise the evaluation of both 'soft tissue' RAS and orthopaedic RAS.

NICE is using the Early Value Assessment (EVA) approach to produce guidance for these topics. This approach allows more rapid assessment of clinical effectiveness and value for money for the most in demand, promising technologies, so that the NHS and patients can benefit sooner. The product assessments are published as health technology evaluations.

The guidance, published on 17 April 2025, recommends 11 RAS technologies that can be used in the NHS during the evidence generation period, if they have regulatory approval and the required evidence is being generated. The guidance also includes advice on how to minimise implementation and system risks due to early access to RAS.

Links to further details on the evaluations and to access the draft guidance are below.

NICE EVA on RAS for soft-tissue procedures >

NICE EVA on RAS for orthopaedic procedures >

Medical Technologies Advisory Committee: This committee has now considered the evidence and the views of clinical and patient experts. EVA guidance recommendations are conditional while more evidence is generated to address uncertainty in their evidence base.

Further Evidence Generation: Over the next 3 years, further evidence must be generated to assess if the benefits of these technologies are realised in practice. The device manufacturers must confirm that agreements are in place to generate the evidence (as outlined in NICE's evidence generation plan). They should contact NICE annually to confirm that evidence is being generated and analysed as planned. NICE may revise or withdraw the guidance if these conditions are not met.

Supporting the Evidence Generation Plan: given the scale of evidence that is required to evaluate RAS, NHS England are committed to work with NICE and other relevant stakeholders to establish a national framework for evidence generation. Industry engagement will be crucial to this process. The Association of British Healthcare Industries and device manufacturers will be consulted on framework design to ensure that there is equitable access for existing and future device manufacturers to submit their evidence generation plans.

6. Research needs

Key quality actions

- Inform research plans using the Evidence Generation recommendations from NICE.
- Data on safety, cost-effectiveness and clinical effectiveness will be required.
- Research studies should consider other areas pertinent to expansion of RAS programmes such as:
  - Implementation
  - Efficient pathway designs
  - Novel pathways in RAS
  - PREMs and PROMs
  - Workforce benefits.

Further information

Recommended document	Author	Overview
A plan for digital health and social care	Department of Health and Social Care	Policy paper from June 2022 setting out commitment to more rapid adoption of proven technology, digitisation, closer working with technology companies and systematising technological research and development partnerships.
NHS Long Term Workforce Plan	NHS England	The Long Term Workforce Plan stated that NHS England would work with professions to embrace technological innovations including RAS, by convening an expert group.
Robot-assisted surgery for soft tissue procedures: early value assessment	NICE	NICE has approved 5 RAS systems for use in soft-tissue procedures while further evidence is collected over the next three years, in their early value assessment published on 17 April 2025.
Robot-assisted surgery for orthopaedic procedures: early value assessment	NICE	NICE has approved 6 RAS systems for use in orthopaedic surgery while further evidence is collected over the next three years, in their early value assessment published on 17 April 2025.
Managing Medical Devices	MHRA	Medicines and Healthcare products Regulatory Agency guidance for

		healthcare and social services organisations on managing medical devices in practice, published in 2014.
RCS of England guidance on RAS	Royal College of Surgeons of England	Guidance on robotic-assisted surgery, which addresses the challenges and the promises of RAS, and provides recommendations on its safe adoption and sustainable expansion in the UK
RCS of Edinburgh guide to RAS	Royal College of Surgeons of Edinburgh	Guidance highlighting areas of best practice when developing robotic surgical services encompassing areas of clinical governance and training.
RCSI guide to RAS	Royal College of Surgeons of Ireland	Guide offering a structured approach to the adoption of robotic surgery to enable healthcare institutions and surgeons to navigate the rapidly evolving landscape of surgical technology.
Experts vs super-experts: differences in automated performance metrics and clinical outcomes for robot-assisted radical prostatectomy	Hung, A.J., et al.	Comparative study published in 2019.
Evaluation of objective tools and artificial intelligence in robotic surgery technical skills assessment	Boal, M.W.E., et al.	Systematic review published in 2024.
Measures of performance and proficiency in robotic assisted surgery	El-Sayed, C., et al.	Systematic review published in 2024.

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Sub-committee members will be listed as contributors later in the document.

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Project support

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Appendix

Reviewing and revising surgical curricula and summary statements from Specialty Advisory Committees (SACs) and statement from the Association of Surgeons in Training (ASiT)

The Joint Committee on Surgical Training (JCST) is an advisory body to the four surgical Royal Colleges of the UK and Ireland for all matters related to surgical training and works closely with the Surgical Specialty Associations and the General Medical Council (GMC), the regulator of the profession. The JCST is the parent body for all ten surgical Specialty Advisory Committees (SAC), the Core Surgical Training Advisory Committee (CSTAC) and the Training Interface Groups (TIGs).

Surgical curricula are dynamic and regularly reviewed to reflect changes in medical science, technology, healthcare delivery, and societal needs. Updates to the curriculum typically occur on a cyclical basis, such as every four years or as needs arise. The goal of these updates is to ensure that surgical training remains up-to-date, evidence-based, and aligned with the evolving needs of the healthcare system.

The UK surgical curricula are designed, developed, and maintained by the Joint Committee on Surgical Training (JCST) in accordance with the General Medical Council's (GMC) Excellence by Design: Standards for Postgraduate Curricula (2017). Curricula are outcomes-based, aiming to prepare residents to be day-one consultants in each specialty while also focusing on the generic professional capabilities that are essential for all doctors.

The development and modification of the curricula follows a structured, multi-step process and input from a variety of stakeholders, including lay professionals, educators, trainees, trainers, training units, and healthcare providers. Consultation with stakeholders involves a thorough evaluation of the proposed changes to understand the likely impact on all involved, also endeavouring to ensure that no group of residents is disadvantaged by the proposed adjustments.

All new and modified curricula must receive GMC approval, which involves a two-stage process. Stage 1 involves the approval of the curriculum purpose statement, which defines why the curriculum is needed and how it aligns with strategic workforce requirements. Support from the GMC's Curriculum Oversight Group (COG) is required, representing organisations responsible for UK medical workforce planning and education, including the four statutory education bodies of the UK. Stage 2 approves all the other components of the curricula, including the program of learning and assessment, as well as systems for quality assurance, governance, and strategic support. These components are evaluated against the

GMC standards by the GMC's Curriculum Advisory Group (CAG), which comprises medical educationalists, consultants, lay professionals, resident representatives, and psychometricians. Feedback from employer representatives and postgraduate medical deans is also sought to assess the feasibility and deliverability of the curriculum or assessment program.

By following these rigorous processes and involving a broad range of stakeholders, the surgical curricula are regularly updated to ensure they meet the needs of the healthcare system and the population they serve. The latest iteration of the surgical curriculum for all ten specialties is ongoing and there remains **no specific requirement within it for evidence of robotic capabilities**, however each SAC has produced a statement related to individual development within the field.

Otolaryngology SAC (ENT)

Transoral robotic surgery (TORS) is the most common form of robot assisted head and neck surgery. Since its introduction in the UK in 2010, TORS has seen a rapid expansion and is now offered around 25 units. In future, it is anticipated that existing or newer platforms may be configured specifically for head and neck procedures thereby overcoming the constraints some head and neck surgeons face when adapting platforms designed for other procedures.

In cancer surgery, TORS is employed both for diagnostic surgery and therapeutic pharyngeal and supraglottic larynx resections. Indications for TORS have evolved into retropharyngeal lymph node excision and removal of benign parapharyngeal tumours and in some cases tongue base reduction for obstructive sleep apnoea. Trans-vesicular robot assisted thyroid and parathyroid surgery are currently being explored in tertiary centres in the UK and have been performed for several years in Asia.

Training has so far been industry-led, with consultant level training supported by a small number of proctors. Many senior head and neck surgery trainees gain surgical proficiency during robotic fellowships or recognised head and neck oncology fellowships but there is no standardised pathway at present.

Urology SAC

Robotic surgery forms an integral part of UK urology. The Urology SAC recognises the need for high quality training in this area. RAS is a widespread technique in the special interest module in oncology. Residents are expected to demonstrate competence in nephrectomy, prostatectomy, and cystectomy for which a robotic approach is commonly used. Knowledge and understanding of RAS is assessed as part of general competence and forms part of the

recommendation for CCT. In the future the urology SAC would support further developments in bringing robotic exposure earlier into the training program.

General Surgery SAC

Robotic assisted surgery (RAS) has rapidly advanced as an important method among the other minimally invasive techniques in general surgery. RAS has been successfully applied in several fields of general surgery including colorectal, hepatobiliary, upper GI and endocrine surgery. The General surgery SAC recognises the need for structured training in this rapidly developing field. The SAC fully supports a vision of looking forward to working with all relevant parties to develop a set of national training standards and enhance the readiness of the workforce to meet the rapidly expanding robotic technology.

Trauma and Orthopaedics SAC

Robotic assisted surgery (RAS) is an expanding field within trauma and orthopaedics, particularly within the subspeciality areas of arthroplasty and spine surgery. There is currently an expanding volume of high-quality evidence comparing patient outcomes with robotic and manual arthroplasty techniques. Currently, the number of hospitals that have access to RAS in orthopaedics is expanding but it is less widespread than in other surgical subspecialties. The orthopaedic SAC appreciates that this is an expanding field and to adequately prepare our residents of today to be the consultants of tomorrow we will need to support training in this field. We therefore support the work already put in place by the Royal Colleges and the BOA in setting up a best practice guide for delivering a robotic arthroplasty service within the NHS. Current WBAs have not yet been adapted to include RAS but this will be monitored and altered if deemed appropriate.

Neurosurgery SAC

Although one of the first robotic surgical procedures was a brain biopsy (in the mid1980s) the subsequent development of robotics in neurosurgery has been very gradual and robotic neurosurgery in the UK is still at an early stage of implementation. Some units have robotic systems which predominantly work with image guidance systems in setting up trajectories for biopsies of deep tumours or implantation of neuro-stimulator electrodes, but there are several different competing systems in use and all these procedures are still commonly carried out without robotic assistance at present. It seems likely that procedures such as accurately targeting lesions in the brain and precise screw placements in spinal surgery will increasingly use robotics in the years to come but at present none of these is sufficiently universally used to justify its specific incorporation in logbooks.

Paediatric Surgery SAC

Robotic surgery is currently gaining more ground in paediatrics as another minimally invasive technique/tool. It has been successfully utilised in different fields such as colorectal, upper GI, urology and oncology surgery as reported in the literature. Currently a very small number of centres in the UK are available for robotic surgery. However, with the continuous improvement of robotic instruments to become more adaptable for children, this will result in further expansion of the utilisation of robotic surgery in children in the UK in the next few years. The SAC supports and recognises the need for future structure training in this rapidly developing field in paediatric surgery and will be looking forward to learning from pre-existing experience from specialties already ahead in this field e.g. urology and general surgery and work with other surgical specialties to develop a set of national training standards.

Vascular Surgery SAC

The application of robotic surgical platforms in vascular surgery has progressed slowly. There are a few centres around the world who have published encouraging results from laparoscopic robotic surgery for aorto-iliac and aneurysmal aortic disease, however, the wide uptake of endovascular technologies has limited the need for alternative minimally invasive approaches. Endovascular robotic catheter systems have shown promise with early clinical reports from centres in UK, Europe and US demonstrating potential to facilitate complex endovascular tasks, reduce occupational radiation exposure to the operator and short learning curves. The main barrier to adoption and wider use remains the cost associated with manufacturing, system installations and consumables. The Vascular SAC are keen to keep an open mind on the application of these techniques and support their uptake with appropriate clinical governance.

Cardiothoracic Surgery SAC

The adoption of robotic-assisted surgery is at different stages within cardiac and thoracic surgery, necessitating tailored approaches to its development and implementation. Cardiac and thoracic surgical procedures are of higher complexity and lower volume than other specialties, which has limited the growth of robotic-assisted surgery in terms of the number of procedures.

Thoracic

Robotic surgery is rapidly expanding within UK thoracic surgery. Its primary application is cancer surgery, alongside increasing use in benign procedures such as diaphragmatic surgery, lung volume reduction, and mediastinal procedures. While implementation varies

across different units, robotic surgery has already surpassed standard thoracoscopy for cancer surgery in established centres.

Training pathways exist within established thoracic centres, but there remains a clear need for national standardisation to ensure equitable access for trainees across the country. The current cardiothoracic curriculum is being updated to include robotic surgery, reflecting this evolution in practice. As such, robotic training courses are now being integrated into resident training programmes to move away from a fellowship-based model and develop a broader, structured approach, as seen in Urology.

Provision for the training of consultants must be improved, and it is recommended that non-RAS consultants and teams be granted leave of absence for focused, intensive RAS training (e.g., 1–3 months) to ensure widespread competency.

Cardiac

Cardiac surgery is at an earlier stage of adoption, partly due to licensing issues for intracardiac surgery related to a recent change in European Medical Device Regulations, and is only available in a few high-volume institutions in the UK. Robotic LIMA harvest will likely see significant growth in the coming years and will need to be incorporated into the curriculum. Current training for robotic mitral valve repair is fellowship-based, predominantly in the US.

While a single-provider technology landscape has potential benefits, fostering competition and innovation is essential. A system that allows multiple providers to compete will be crucial in ensuring technological advancement and accessibility across the UK.

Association of Surgeons in Training (ASIT) statement

Training and resident surgeon bodies support the introduction of the principles of RAS from medical school onwards. There should be equitable, platform agnostic, access to training irrespective of geographical location or working pattern. This training should be coordinated and delivered within training by NHS England Workforce, Training and Education. Such training should be formed of a combination of stage-specific courses delivered as part of school/region teaching programme/bootcamps and bespoke courses applied for and funded through individual study leave application. Robotic training should include device training, basic skills training, simulation training and supervised procedural training, these should be credentialed to optimise feedback and evaluation.