Board Meeting
3 12 20
Open Session
Item 6

BUSINESS CASE FOR THE DEVELOPMENT OF ROBOTIC ASSISTED SURGERY

DIVISION OF SURGERY

NHS GRAMPIAN ACUTE SECTOR

November 2020

(FINAL DRAFT)

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1.0 Executive Summary

Robotic Assisted Surgery (RAS) allows doctors to perform complex procedures with more precision, flexibility and control than is possible with conventional techniques. Robotic surgery is usually associated with minimally invasive surgery – procedures performed through small (keyhole) incisions. The robotic technology is in the form of a master/slave system such that, the surgeon is able to manipulate instruments attached to the patient from a nearby console with fine dexterity under magnification to make precise incisions inside the patient. The robot is never ever making decisions.

RAS is now being widely used and expected to become the norm, with this, bringing significant and wide ranging benefits. RAS has addressed many of the inherent limitations of the laparoscopic (also known as keyhole) approach thus making it possible to perform complex surgical procedures in hard to reach areas.

In collaboration with the University of Aberdeen, the Health Services Research Unit and our surgical teams and staff, we aim to be a centre of excellence for robotic treatment, training and research. This will not only ensure delivery of innovative and efficient high quality outcome focussed care but ensure we are employer of choice, supporting our recruitment and retention capabilities and ensuring future service sustainability.

1.1 Introduction

We seek support from NHS Grampian Board on behalf of the Acute Sector to purchase two additional surgical robots and accelerate the replacement of the existing robot.

Our aim is to continue the development of a comprehensive world class minimally invasive robotic assisted surgical service which will ultimately replace current techniques of both open and laparoscopic surgery. This transformation will deliver across the Division of Surgery, improvements in a range of outcomes already realised with the robot delivering surgery for the Urology Service.

In 2014, as part of the strategic delivery plan the Board approved investment in two Minimum Invasive Theatres (MITs) at Aberdeen Royal Infirmary. This approval recognised the future benefits for patients and our healthcare system of introducing minimally invasive Robotic Assisted Surgery (RAS) in a controlled and staged manner.

In June 2015, the Board approved the business case for the purchase of our first robot (Da Vinci Robotic Assisted Surgical (Si) system). This decision resulted in NHS Grampian providing the first RAS service in Scotland, with the first patient treated for Prostate Cancer in August 2015.

The development of RAS across Scotland has become a priority due to the increasing evidence and associated benefits. A National RAS Oversight Programme

Board has been established by the National Planning Board to oversee the development and delivery of the agreed vision and future model of RAS in Scotland. A National Strategic Framework for RAS was presented to the National Planning Board in May 2020 who endorsed this and the need for a systematic shift to RAS for key types of surgery.

Our current robotic system cannot provide any access to the demand from other clinical teams within the Division of Surgery. Funding has been made available by the Scottish Government during 2020/21 to support the expansion of robotic surgery across Scotland in line with the national programme for RAS.

In 2020 we hope to build on our learning to date, improve clinical outcomes for patients across many services, minimise the economic cost of harm and bring a positive impact across our systems. Support from the NHS Grampian Board will deliver the following benefits.

1.2 Benefits to Patients/Population

Direct Patient Benefits *(those accessing the service from Grampian/other Board areas)*

- Improved health and clinical outcomes for those directly accessing these services
- More patients will be able to access RAS due to:
    - increased efficiencies/productivity (achieved across the whole pathway of surgical care)
    - widened scope of potential patients able to undergo surgery who are not suitable for traditional surgical methods, reducing inequalities across population groups
    - more surgeons enabled to offer minimally invasive surgical approach through RAS
- Reduction in complications, pain, blood loss and infections
- Less likelihood of surgeon error
- Reduced length of hospital stay and therefore less time away from family/home environment
- Shorter recovery time, allowing quicker return to work/normal activities which reduces the risk of negative impacts such as income/personal finances, social isolation and mental health and wellbeing
- Preservation of function and improved quality of life
- Reduced waiting time

In addition to the benefits experienced by patients outlined above, we would anticipate that for orthopaedics, with the efficiency benefits gained from the reduction in length of stay, the conversion of 675 cases to robotic surgery this would release capacity for an additional 112 orthopaedic procedures per annum. This includes the conversion of 225 total knee replacement cases to partial knee replacement procedures.

In relation to general surgery, we would anticipate that with the length of stay reduction achieved with the shift to robotic surgery, this would release capacity for an additional 72 general surgery procedures per annum. This includes the predicted conversation of circa 50% open/laparoscopic cases to robotic. In addition to this, it is

anticipated that this will also support us to appropriately and effectively change the treatment plan for potentially 50 individuals, reducing pressure on other cancer treatment services.

Indirect Benefits for Patients/Wider Population

- Improved access to community health and social care services for wider population due to:
    - the reduced demand on post-operative requirements by those patients accessing robotics
    - reduced incidence of wound infection managed in community due to smaller incisions
    - reduced demand due to prevention/reduction of morbidities associated with open and laparoscopic procedures due to the transition to RAS
- Patient benefits of RAS outlined above will have some positive impacts on society and wider detriments of health and smaller socioeconomic impact, for example
    - shorter recovery time supporting a quicker return to work/normal activities, minimising negative impacts such as reduced income/financial consequences, social isolation and personal/family mental health and wellbeing
    - preserved function/improved quality of life with reduced dependency on health and social care/wider support services

1.3 Clinical Gains

- Timely, person centred care
- Continued safety of patients and staff
- Improvements in patient experience and outcomes (person-centred)
- Improved access, quality and efficiency of key diagnostic and treatment processes (high quality),
- Improved health equality with better ability to safely offer complex life-saving and quality of life operative procedures to higher risk profile patients (person-centred),
- Reduced length of stay in an acute setting, reduced operating time and reduced requirements for care in other parts of the health and care system (sustainable)
- Lower complication, lower re-operation rates, quicker recovery times and better long term outcomes (safe and person-centred),
- Improved recruitment and retention of key staff (sustainable).
- Reduced time for training for surgeons
- Reduction in unwarranted variation

This will also support addressing a number of the challenges and opportunities across NHS Grampian:

- Manage the impact of COVID on the delivery of elective surgical care currently compromised due to competing needs for critical care facilities, reduced surgical bed capacity and theatre efficiency
- Ongoing recruitment and retention challenges in Grampian which has depended on increased use of agency/locum staff

- Service Sustainability
- Many services pathways have optimised their threshold in productivity linked to enhanced recovery and other improvement initiatives
- Finite people, skills and resources, therefore critical all are used optimally to maximise health outcomes for the population
- This proposal will also support greater collaboration resulting in increased sustainability and flexibility across the north as part of the wider regional plan to expand RAS.

1.4 Strategic Gains

This proposal has a strong strategic case. It meets the objectives of NHS Grampian and those set out regionally and nationally. The proposal is compliant with relevant national, regional and local clinical care and health strategies, in particular:

- A National Clinical Strategy For Scotland
- Realistic Medicine
- Grampian Clinical Strategy 2016 – 2021
- NHS Grampian Acute Sector Strategic Plan 2020-2023
- National Framework for Robotic Assisted Surgery (May 2020)
- Beating Cancer: Ambition and Action
- Beating Cancer: Ambition and Action in Grampian
- Our Commitment to Research 2019-2023

1.5 Financial Implications of Proposal

The investment required to deliver the proposal is set out below.

Capital Costs

Capital	Mako Robot Orthopaedics	Da Vinci xi General Surgery	Da Vinci xi Urology (replacement)	Total
Expenditure	**£000's**	**£000's**	**£000's**	**£000's**
Robotic Surgery Equipment	1,173	2202	2202	5577
Decontamination equipment		155		155
Electrical Infrastructure	5	5		10
Total Capital expenditure	**1,178**	**2,362**	**2,202**	**5,742**
Total available funds	**1,178**	**2,362**	**2,202**	**5,742**

The above costs assume the following:-

a. All costs include Value added Tax (VAT) at 20%.

b. Investment in an additional Sterrad and ultrasound washer to ensure 24 hour turnaround standard (6 hours for fast track items) and to improve resilience by doubling the number of units capable of cleaning the robotic instruments and avoiding the need to send instruments outwith Grampian down to Newcastle for sterilisation during periods of down time.

c. A small provision for the installation of additional electrical sockets is included. No other significant reconfiguration or enabling works are required to accommodate installation of the equipment in either of the operating theatres or within the decontamination service.

Revenue Costs

The annual revenue costs, after the first year of operation, are assessed as follows:-

Revenue	Mako Robot Total & Partial Knee and Total Hip	Da Vinci xi General Surgery	Da Vinci xi Urology (replacement	Total
	£000's	£000's	£000's	£000's
Total Direct Revenue Costs	**393**	**639**	**585**	**1,617**
Less current service costs		**415**	**689**	**1,104**
Net recurring operating costs	**393**	**224**	**(104)**	**513**
Depreciation	**117**	**233**	**220**	**570**
Increase in recurring costs	**510**	**457**	**116**	**1,083**

The above cost analysis assumes the following:-

a. Anticipated annual Robotic surgery activity levels of 300+ Colonic Resections and 225 less complex procedures for General surgery; 225 total hips, 225 total knees and 225 partial knee replacements per annum in Orthopaedics and maintain current activity levels in Urology.

b. Benefit in Urology from improved life of instruments (from existing 10 uses to between 15-18 uses).

c. Additional Radiography staffing required to support CT scanning as part of pre-procedure treatment with the Mako robot – calculated as 7.5 hours per week Agenda for Change (afc) 5.

d. A Robotic Theatre co-ordinator afc band 7 will be required to assist the surgical team in the system set up and running of the Da Vinci system (General surgery and Urology) before and during all scheduled cases. The contract for supply of the Mako Robot will include this service provided

e. Depreciation calculated on a straight line basis over a 10 year economic useful life in line with the Board's accounting policies for non-imaging equipment.

f. Ongoing Maintenance and Technical service cover is based on the indicative quote from the system suppliers for a fully comprehensive maintenance package.

Opportunities to Mitigate Costs

Section 2.6.2 outlines the potential efficiency and productivity benefits which include improved recruitment and retention into key, hard to fill clinical roles and the significant reduction in the length of patient stay in hospital. The main benefits that accrue from implementation however, relate mainly to the patients experience - reduced operating times and improved accuracy allow a quicker recovery with less pain, an ability to get back to normal activity faster and lower complication and re-operation rates with better long term functional outcomes. There is a financial benefit associated with these direct clinical benefits but this is more difficult to estimate and extrapolate.

Funding Availability

Provision has been made in the Board's five year financial plan for the costs associated with this development.

1.6 Evidence from the Literature

A range of complex published modelling reports have been produced that have drawn data from a range of studies to assess this technology. Amongst this evidence base is work done through the Health Service Research Unit, University of Aberdeen - clinicians from NHS Grampian in collaboration with other centers.[1] [2] [3] These publications suggest that whilst the immediate costs of RAS are greater than laparoscopic technology the clinical outcomes are significantly improved and provided there is sufficient volume these improved outcomes and avoidance of harm translate over a 10 year period to be cost effective. Currently, evidence from high quality randomized clinical trials with economic analysis is not available to draw from.

1.7 Justification

This proposal is consistent with the objectives as set out in NHS Grampian's Acute Sector Strategic Plan, the Grampian Clinical Strategy, the Grampian Remobilisation Plan, the planned RAS expansion in the North and the National RAS Oversight Programme Board. There is universal support from clinicians and staff across a range of services within the Acute Sector.

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[1] Robertson C, et al. Relative effectiveness of robot-assisted and standard laparoscopic prostatectomy as alternatives to open radical prostatectomy for treatment of localised prostate cancer: a systematic review and mixed treatment comparison meta-analysis. *BJU Int. 2013; 112: 798–812*

[2] Close A, et al. Comparative Cost-effectiveness of Robot-assisted and Standard Laparoscopic Prostatectomy as Alternatives to Open Radical Prostatectomy for Treatment of Men with Localised Prostate Cancer: A Health Technology Assessment from the Perspective of the UK National Health Service. European Urology. 2013; 64, Issue 3, 347-522

[3] Ramsay C, et al. Systematic review and economic modelling of the relative clinical benefit and cost-effectiveness of laparoscopic surgery and robotic surgery for removal of the prostate in men with localised prostate cancer. Health Technology Assessment 2012; Vol. 16: No. 41

The Business Case has been endorsed by members of the Acute Sector Leadership Team and the NHS Grampian System Leadership Team. Patients will benefit from surgery which is of greater precision and in the case of cancer, related intervention outcomes demonstrate superior recurrence free survival, better functional outcome and fewer interventions at follow- up over time. The paper details the range of clinical, economic and strategic benefits associated with the proposal which if not realised, may become areas of weakness. Our journey to RAS is being mirrored across Scotland, the UK and internationally.

Robotic Assisted Surgery Business Case on a Page

Vision

To expand robotic assisted surgery (RAS) so that all eligible patients receive this ensuring optimised health and clinical outcomes, supporting improved and maximised utilisation of resources across the health and care pathway and Grampian is recognised as a centre of excellence for RAS delivery, training and research.

Outcomes

- Improved Patient Outcomes
- Reduced Complications & Hospital Stay
- Quicker Return to Daily Activities & Improved Quality of Life
- Improved Access & Reduced Waiting Times
- Enhanced Use of Resources Across the System

Investment Objectives

1. Safe, person-centered and outcome focused care
2. Staff health, wellbeing and safety
3. Improved effectiveness and efficient care
4. Tackling inequalities
5. Developing a sustainable workforce

Need for Change & Benefits

Need for Change

- Shift in realistic medicine to optimise person-centred care, reduce unwarranted variation, reduce harm & waste, and improve & innovate
- Grampian Clinical Strategy – shift activity from unscheduled to planned and planned to self-management and prevention
- Overwhelming evidence base re significant benefits for Minimally Invasive RAS – patients, staff & organisations
- National ambition to improve access & adoption of MIS surgery across Scotland
- Improved equity of access & reduce inequalities
- Continued safety of patients and staff
- Time & capacity required for training surgeons
- Impact of COVID has resulted in reduced capacity & productivity
- Services have optimised threshold in productivity
- Workforce recruitment & retention challenges
- Finite people, skills & resources & requirement to ensure these are optimally maximised
- Service sustainability challenges

Benefits

Patient/Population

- Improved health & clinical outcomes
- Widens the scope of potential patients able to undergo surgery, reducing inequalities across population groups
- Reduction in complications, pain, blood loss & infections
- Less likelihood of surgeon error
- Shorter recovery time & reduced length of hospital stay
- Preservation of function
- Quicker return to work/normal activities
- Reduced demand on post-operative requirements for community health & social care resulting in better access to such services for other individuals
- Shorter recovery times lead to smaller socioeconomic impact i.e. time of work etc.

Staff, Service & Organisation

- Higher volume of cases undertaken
- Lower surgical revision rates
- Increases attractiveness of service, improving recruitment & retention & enhances sustainability of service
- Research, training and development opportunities to attract workforce
- Shorter learning curve means surgeons are independent quicker & larger cohort of surgeons can utilise robotic surgery
- Reduction in repetitive strain injury
- Optimal use of available resources
- Reputational benefits as NHS Grampian is established as a Centre of Excellence & Boards commitment to Research
- Increases opportunities to improve recruitment & retention across services

Stages

3rd Dec 2020	Dec 2020 / Jan 2021	By 31st Mar 2021	By 31st Jul 2021	Aug 2021 - 31st Mar 2022	
Case Submitted to Board for Endorsement	Procurement Awarded & Data Protection Compliant	Install Kit, Train Staff & Protocols Agreed	Phase 1 – Optimise Current Theatre Capacity	Phase 2 • Optimise Theatre Capacity • Contribute to Research • RAS & Training Centre of Excellence	Agree Next Stage of Development Based on Evidence & Evaluation

Evaluation

Draft V3

Robotic Assisted Surgery Business Case Summary Check List	Additional Surgical Robot	Replacement Urology Robot	Orthopaedic Robot
Strategic			
Grampian Clinical Strategy – shift to planned, self management & prevention, enhancing sustainability, whilst reducing inequalities	✓	✓	✓
Remobilisation of Priority Surgical Cancer & Non-Cancer Pathways to optimise outcomes & maximise available resources	✓	✓	✓
Acute Strategic Plan - ambition to be a centre for excellence for quality clinical care, training, research and innovation	✓	✓	✓
National Ambition & National Framework for Increasing Access to minimally invasive RAS across Scotland	✓	✓	
National Clinical Strategy & Realising Realistic Medicine	✓	✓	✓
Regional Priorities Around Cancer, Priority Elective Care Pathways & Sustainability of Services Across the North	✓	✓	
Case for Change			
Reducing Inequalities & Access Times to Surgical Pathways to optimise health outcomes for the whole population	✓	✓	✓
Timely, person centred care – right care, right time, right place & right individual/team	✓	✓	✓
Reduction in unwarranted variation and minimise harm to patients and staff	✓	✓	✓
Need to be innovative due to capacity and resource limitations	✓	✓	✓
Impact of COVID has resulted in reduced capacity and productivity & learning to date that RAS has supported minimising risk	✓	✓	✓
Recruitment and retention challenges, time to train staff all affecting sustainability of workforce and service models	✓	✓	✓
Sustainability of services across the health and care system – increasing demands, workforce challenges & finite resources	✓	✓	✓
Benefits			
Patients - improved access for more people, optimised outcomes & experience, reduced LoS, quicker recovery, lower complication rates & harm, etc.	✓	✓	✓
Population - by releasing demand on community H&SC services this will improve access for other individuals who require these community services	✓	✓	✓
Staff/Service – staff safety, reputation for excellence, attractiveness re recruitment, development opportunities, shorter training time, sustainability etc.	✓	✓	✓
Organisation – increased productivity/use of resources, reputation as employer of choice, research & innovation, increasing service sustainability etc.	✓	✓	✓
Wider System - Reduced (short/long term) disability & shorter recovery time reduces socioeconomic impact i.e. time of work, dependencies etc.	✓	✓	✓
Unintended Consequences & Risks			
Health Inequalities Impact Assessment Undertaken	✓	✓	✓
Clear Understanding of financial costs, opportunity costs & benefits for services and across the system	✓	✓	✓
Clear understanding or risks of undertaking the proposal and the risks of not proceeding	✓	✓	✓

2.0 Strategic Case

2.1 Introduction

The surgical model of care worldwide has transitioned over the years with the shift from open surgery to less invasive laparoscopic (key hole) surgery and is now transitioning to minimally invasive Robotic Assisted Surgery (RAS) being the norm and with this, bringing significant and wide ranging benefits. RAS has addressed many of the inherent limitations of the laparoscopic approach thus making it possible to perform complex surgical procedures that traditionally can only be attempted by specific highly trained and skilled operators.

The need to transition and expand RAS is fully aligned to the strategic intent of the organisation as set out in the Grampian Clinical Strategy and the recent Acute Sector Strategic Plan 2020-23, supported by the Board on 6th February 2020.

In 2014, as part of the strategic delivery plan the Board approved investment in two Minimum Invasive Theatres (MITs) at Aberdeen Royal Infirmary. This approval recognised the future benefits for patients and our healthcare system of introducing minimally invasive Robotic Assisted Surgery (RAS) in a controlled and staged manner. In June 2015, the Board approved the business case for NHS Grampian to be the first Board in Scotland to introduce robotic Minimally Invasive Surgery and to complete the purchase of our first robot (Da Vinci Robotic Assisted Surgical (Si) system), partly funded by charitable donations. The Business Case set out the ambition, the phased implementation plan, along with the anticipated wide ranging benefits to patients, staff and the organisation. The ambition and plan was supported by a range of local, regional and national partners, including the Cabinet Secretary.

The phased plan focussed on the commencing of robotic surgery for radical prostatectomy within the Urology Service, with expansion beyond this as guided by a clinical expert group determining the clinical priorities based on available evidence. This was in line with the work of the National Planning Forum as requested by the Cabinet Secretary in 2013. Significant benefits have been realised as evidenced, along with the case to further expand access to RAS for other patients in Grampian and the wider North of Scotland.

As part of the national programme for delivering the National RAS Framework, the Scottish Government is supporting investment in a number of robotic platforms across various centres, including in Grampian.

2.2 Strategic Context

The NHS Grampian Clinical Strategy:

- confirms the direction for clinical services;
- identifies the objectives across the health system to improve outcomes; and
- identifies the changes required to make the health system work more effectively.

Figure 1: High Level Framework of Clinical Strategy

This is consistent with the National Clinical Strategy and the three Integration Joint Board (IJB) Strategic Plans (Aberdeen City, Aberdeenshire and Moray) in relation to providing care closer to home, delivery of sustainable care for the populations we serve, and putting patients and their families at the centre of our care. Figure 1 illustrates the focus on prevention, self-management, planned care and unscheduled care, the necessary shift required, along with the five enablers to support the shift in care.

A key focus of the Grampian Clinical Strategy and Acute Strategic Plan is the delivery of the Scottish Governments Realistic Medicine principles which centre on:

- Personalised approach to care
- Shared decision making
- Reducing harm and waste
- Reduce unwarranted variation
- Managing risk better
- Becoming improvers and innovators

Delivery of these principles will support the shift aspired to within the Grampian Clinical Strategy and IJB Strategies. This will enhance optimal person centred care and outcomes tailored for individuals' needs, whilst maximising resources available across the health and care system, creating more sustainable services in the longer term better capable of meeting the needs of the population.

In February 2020, the Grampian NHS Board supported the draft Acute Sector Strategic Plan 2020-23. The plan over the next three years is to support and develop tertiary and specialist services within Grampian that operate in the context of both regional and national delivery systems. This is embodied in our focus on delivering complex secondary and tertiary planned and emergency interventions. The strategic plan acknowledges the importance of innovation and the need to build on a number of successful projects including:

- Major Trauma Centre for the North of Scotland
- National Hyperbaric Service
- Nationally Designated ECMO Centre for Scotland
- NEAR ME
- Capital Investment, including RAS

NHS Grampian had the ambition to be the first Board in Scotland to implement RAS within urology which went live in 2015. It is still our ambition to continue to be at the leading edge of RAS within Scotland but also be comparable to services in UK and internationally. The delivery of RAS in the Acute Sector will contribute to the delivery of a high quality, modern sustainable delivery model.

2.2.1. National Ambition and Programme

The National Framework lays out a case for change towards a future of MIS via RAS, using the guiding principles of the National Clinical Strategy and Realistic Medicine.

The Framework provides a focus on patient outcomes, reducing unwarranted variation, volume of surgical need, workforce and service efficiency. The Framework structure is graphically demonstrated below in figure 2.

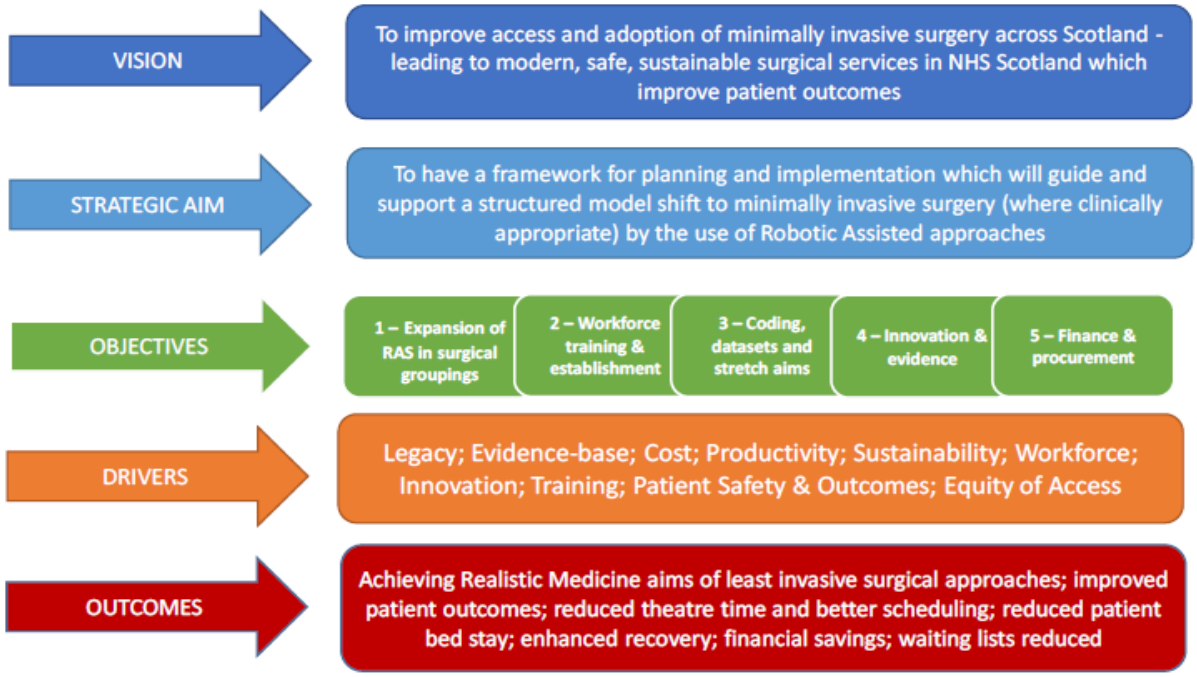


Figure 2: Outline of National Framework for RAS

Vision and Future Model of Care

The National Strategic Framework for RAS aims to improve access and adoption of MIS across Scotland, leading to modern, safe, sustainable surgical services in NHS Scotland which improve patient outcomes.

- NHS Scotland will continue to strive towards day surgery for the BADS procedures;
- NHS Scotland will have increased RAS systems across major surgical centers of expertise;
- MIS will become the normal first considered approach, unless clinically inappropriate – stretch aims for key areas of RAS/MIS will be defined;
- NHS Scotland surgeons and theatre teams will be fully trained and enabled for RAS;
- There will be a national system of capital planning, procurement, and a rolling replacement plan for major RAS equipment;
- There will be a national coding system which effectively captures the mode of surgery; and
- There will be no unwarranted variation in MIS availability or offer of procedures.

Expansion Areas

A suite of surgical areas are suggested as phase 1 expansion nationally, focussing on gynaecology oncology and colorectal; alongside the continued progression in urology and thoracic. Trans Oral, Upper Gastrointestinal and Hepato-Pancreato-Bilary surgery could also be considered a future development to reduce unwarranted

variation. In addition, the volume demand for Orthopaedic RAS systems is also rising.

Key Actions for Local Boards and Regions in Supporting Delivery

Key actions for local boards, regions and nationally are set out within the Framework to support delivery and journey towards overall aims and objectives. The specific actions required by local Boards to support delivery of the agreed Framework are summarised below.

Focus	Board Actions
Expansion of RAS in Surgical Groupings	• Boards with existing RAS systems should create a local RAS Strategic Group to lead exploration of current usage and scope to introduce new areas of surgery within current RAS capacity • Boards with existing RAS systems should agree an action timeline to introduce the new areas
Workforce – Training & Establishment	Should undertake a Training needs analysis in line with local expansion plan
Coding, Datasets & Stretch Aims	Boards should work with the national group on coding improvements and reporting on stretch aims
Innovation & Evidence	Boards should support evidence by evaluation and enables NHSS to be more proactive and timely in its adoption of major disruptive technology
Finance & Procurement	Board to work collegiately with the national group on a once for Scotland approach

Table 1: Board Actions from RAS Framework

The agreed Framework sets out a staged approach which would see regional expansion of RAS across Scotland based on clinical evidence and equity of access. Key actions for regions are set out within the Framework within Appendix 1. NHS Grampian, along with other Boards in the north will have a key role in supporting achievement of these objectives.

2.2.2. Learning from NHS Grampian's Implementation of the Robot in Urology

In 2014, the Board approved the investment in two Minimum Invasive Theatres (MITs) at Aberdeen Royal Infirmary as part of the strategic delivery plan. This recognised the potential benefits associated with enabling a higher rate of MIS.

In 2015, following a fund raising campaign by the UCAN Charity and with additional financial support from the Scottish Government and the NHS Grampian Endowment Funds, the Board approved the purchase of a Da Vinci Robotic Assisted Surgical (Si) system, which was installed in one of the MIT's, initially for the use of the Urology service but with the intention of offering surplus capacity to other specialties as surgical techniques developed.

Since implementation of the robot in August 2015, significant benefits have been seen for urology patients, staff and the organisation. Appendix 2 summarises the benefits set out in the 2015 business case, along with the actual impact realised.

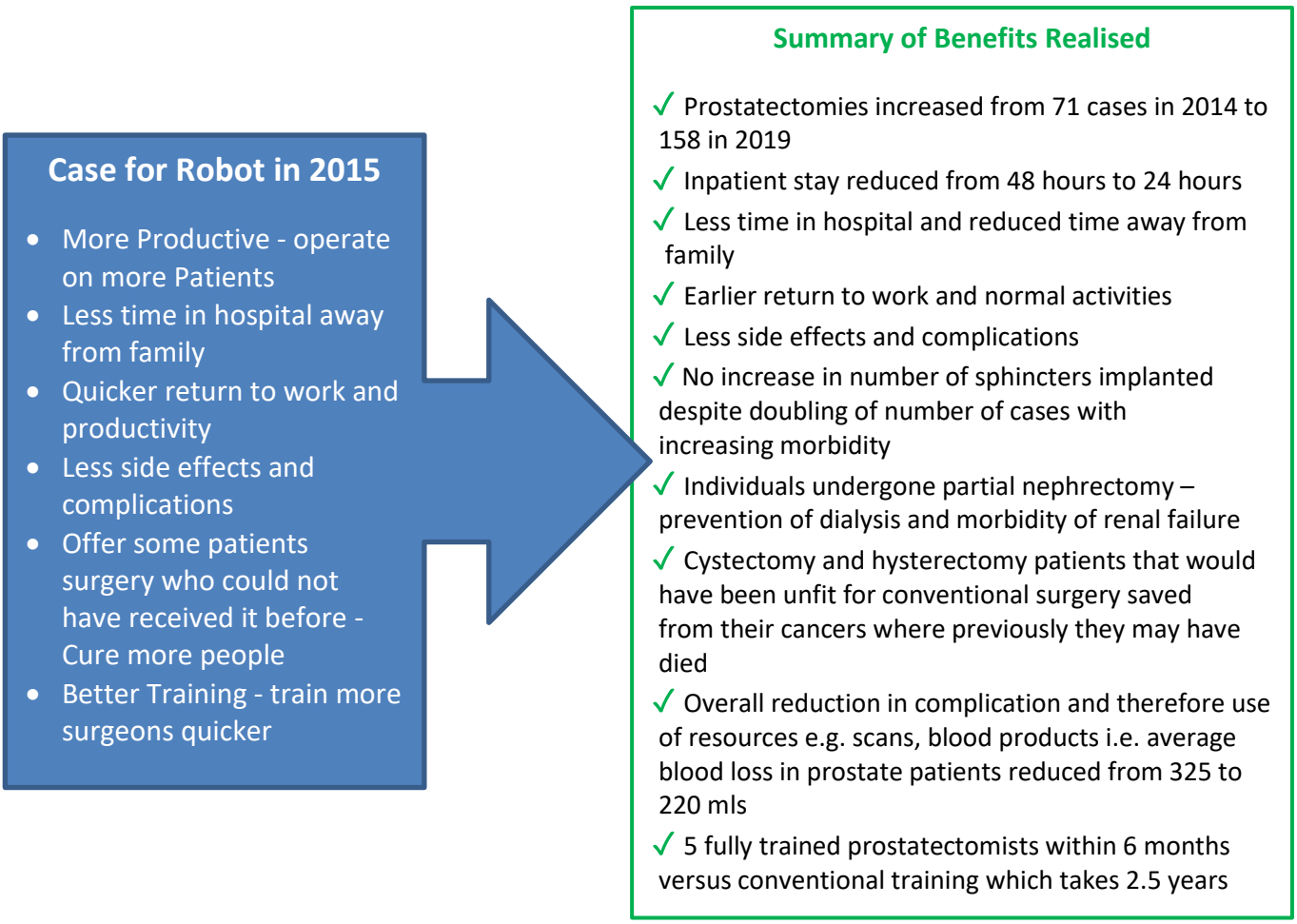


Figure 3: Summary of 2015 Business Case & Benefits Realised

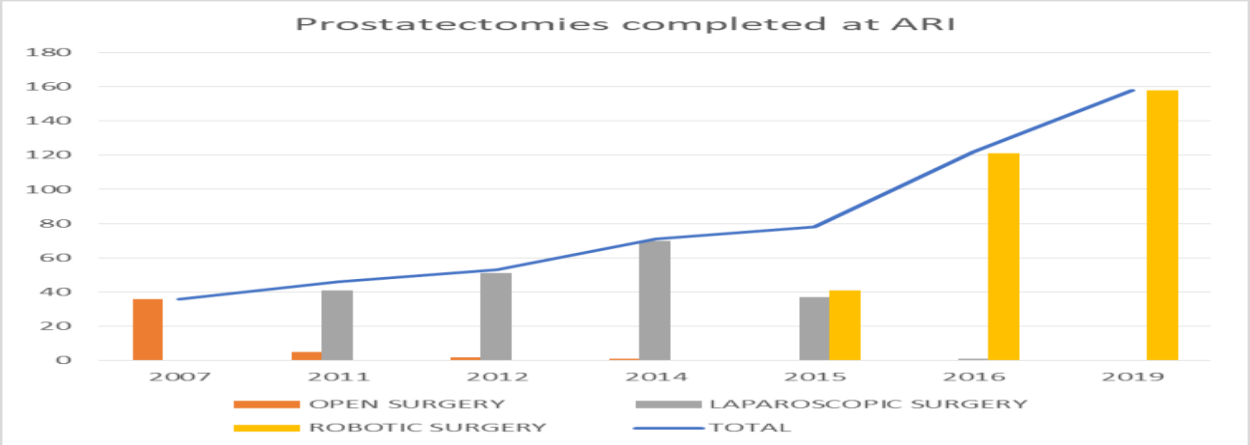
Key achievements to date are:

Operated on close to 1,000 patients with significant benefits, for example:

- In prostatectomy patients:
  - we have seen inpatient stay reduced from 48 to 24 hours
  - we have the best outcomes in Scotland for RAS prostatectomies
  - a significant improvement in function and corresponding reduction in harm including bladder neck stenosis (less need for catheters in the community or further surgery) and other complications such as
    - incontinence
    - sexual dysfunction
    - blood transfusion (rate of less than 0.5 %)
- In cystectomy patients:
  - we have seen a similar decrease in inpatient stay from 16 to 6 days
  - significant decreases in blood loss 1.5 l versus 300ml
- In partial nephrectomy patients, a similar benefit has been seen in terms of reduced blood loss, infections and inpatient stay.

Training:

- We have gone from 1 trained laparoscopic prostatectomist to 5 fully trained robotic surgeons offering the full gambit of minimally invasive urology. This was achieved much faster (within 6 months) than could have been achieved laparoscopically. This opportunity has also been shared by other professionals of the clinical team.
- Increased prostatectomy surgery with 100% of patients receiving this via robotic mode in 2019 (see Graph A).



Graph A: Activity Trend and Mode of Surgery for Prostatectomy 2007-2019

It requires to be noted that these achievements were attained whilst maintaining patient safety and increasing the through-put of the unit.

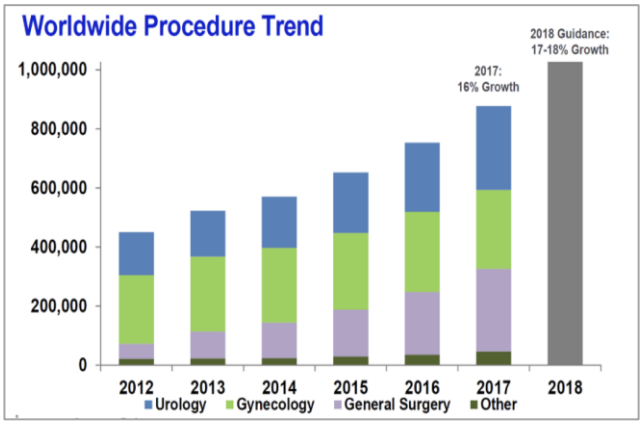
Patients have been appreciative of the decreased hospital stay, especially during the pandemic. Patient experience and feedback on this service has been very positive. This is supported by the recent Health Improvement Scotland review of qualitative evidence available on the use of robotic surgery for various indications. This found that patient satisfaction was high in studies of people who have been treated with robotic surgery, however, it is not clear at this stage if satisfaction is any higher with robotic surgery compared with other minimally invasive techniques.

2.2.3. Evolution of the Surgical Model

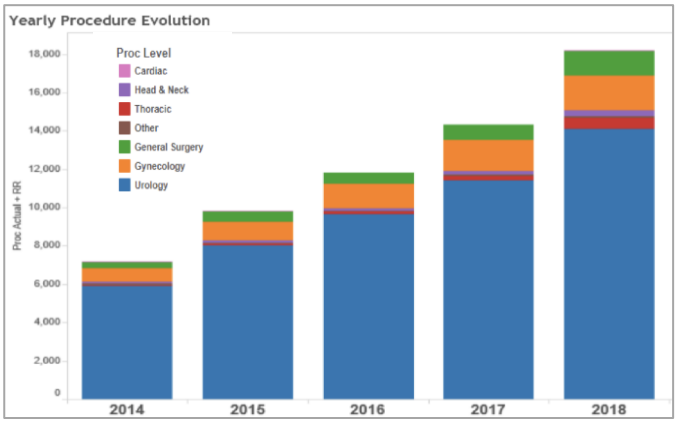
The surgical model of care has transformed over the years with the shift from open surgery to less invasive laparoscopic surgery and is now transitioning to the RAS being the norm and with this, bringing significant and wide ranging benefits. The NHS Grampian Urology Service is a 'real' example of this in relation to prostatectomy (see Graph A above).

Graphs B and C overleaf demonstrate the worldwide and UK trend in the uptake of robotic surgery in various surgical specialities. Both graphs demonstrate increasing trend in implementation of robotics in general surgery and its sub-specialities. This trend is a reflection of the ability to adopt the robotic approach to safely and effectively replace laparoscopic techniques as well as the use of the robotic approach to perform open procedures that are not suitable for laparoscopic approach given their complexity. Complex rectal cancer surgery especially in obese

patients, male patients with a deep narrow pelvis and low lying tumours are particularly challenging via the laparoscopic approach due to the instruments being straight and therefore unable to negotiate the curvatures of pelvic surgery. Similarly oesophageal cancer surgery, major pancreatic resections and advanced liver surgery are not inherently suitable for the laparoscopic approach given the inbuilt limitations of laparoscopic instruments. These procedures are currently performed by open surgery or laparoscopically but with increased rates of conversion to open. Conversion is well known to be associated with increased theatre cost, length of hospital stay and post-operative complications and overall poorer outcomes.



Graph B: Worldwide Procedure Trend in Uptake for RAS



Graph C: UKI Procedure Trend in Uptake for RAS

This trend also reflects the increasingly recognised benefit of the robotic approach to achieve **'indirect or invisible savings'** from reduction in complication rate, improved functional outcomes and reduced impact on community services during convalescence after discharge from the hospital especially for elderly population. One of the well-recognised advantages of the robotic approach is reduction in stoma rates following complex rectal surgery. This results in, not only better quality of life, but also patients' life-long savings from items used in stoma care and dealing with common stoma complications that require re-do high-cost surgery with high risk of complications such as stoma related hernia.

2.3 The Proposal

Various surgical specialities have presented their plans for the next stage in development of RAS in Grampian. These have been supported by the Acute Sector Leadership Team.

To support these proposals we require to:

- Purchase a dedicated Robot for the Orthopaedics RAS service
- Purchase a dedicated Robot for use within the General Surgery RAS service
- Replace the existing Urology Robot with a more advanced model
- Retain the current Urology Robot specifically for training purposes
- Enhance and develop further pioneering decontamination practice

This will bring significant efficiency improvements and allow a cross flow of activity between the General Surgery, Urology and Gynaecology specialities and other specialties such as ENT in time. The existing Urology Robot, soon to be obsolete, will be retained as a training platform thereby ensuring there is minimal downtime for the service in order to support training and accreditation.

The existing Urology Robot is now outdated technology and support from the manufacturer will be withdrawn in the coming years. There is an opportunity to accelerate replacement which will allow a further discount to be negotiated on both machines (General Surgery and Urology) in addition to the immediate clinical and cost efficiency benefits that the new version will allow.

These benefits and impact on each of the surgical services is explained in more detail in the following sections.

2.4 Case for Change

The projected demand and need for RAS from both our population and health professionals will continue to increase for many reasons within NHS Grampian and across Scotland. To support our healthcare professionals to be innovative, pursue continuous quality improvement and to manage risk better we present our proposal for support.

2.4.1. National Policy & Direction

The Project is compliant with relevant national, regional and local clinical care and health strategies, in particular:

- A National Clinical Strategy For Scotland (2016)
- Realistic Medicine (2016)
- Grampian Clinical Strategy 2016 – 2021
- NHS Grampian Acute Sector Strategic Plan 2020-2023
- National Framework for Robotic Assisted Surgery (May 2020)
- Beating Cancer: Ambition and Action (2016)
- Beating Cancer: Ambition and Action in Grampian (2017)
- Our Commitment to Research 2019-2023

The national vision and future model for RAS is set out in Section 2.2.1 - this project will support the delivery towards this.

2.4.2. International Evidence

Robotic Surgery is utilised for a number of different procedures to improve outcomes for patients as well as long term clinical efficiency to service providers. There are a significant number of clinical studies demonstrating efficacy of robotic surgery.

The National Framework for RAS also references a range of reviews of evidence for RAS and specific surgical groupings which can be viewed in full at SHTG Publications.

A summary of these are below.

- Radical prostatectomy for localised prostate cancer (2013)
- Partial nephrectomy compared with open or conventional laparoscopic procedures in patients with T1a or T1b renal cancer (2018)
- Transoral robotic surgery (TORS) for the diagnosis of head and neck cancer of unknown primary (2018)
- Transoral robotic surgery (TORS) for the treatment of oropharyngeal and supraglottic laryngeal cancers (2018)
- Robot-assisted surgery compared with laparoscopic resection for the treatment of rectal cancer (2018)

In addition, as part of the Framework RAS review, a rapid overview of systematic reviews which had examined existing evidence on the clinical effectiveness of RAS was carried out.

In February 2020 a Systematic Review and meta-analysis on function outcomes after laparoscopic versus robotic-assisted rectal resection[4] was undertaken. This suggested that there are potential benefits for RAS over traditional laparoscopy in terms of functional outcomes after rectal cancer resection. The current evidence is limited due to lack of RCT and the reporting of functional outcomes as secondary endpoints.

The evidence base for robotic assisted arthroplasty is contained within Appendix 3.

2.4.3. Individuals Affected By This Proposal

NHS Grampian Board provides a full range of healthcare services for around half a million people who live in Grampian, an area covering 3,000 square miles of city, towns and rural communities. The Health Board also provides specialist tertiary services for the North of Scotland, employing around 17,000 staff. As a teaching Board, it also has close links to the University of Aberdeen and Robert Gordon University.

Across Scotland we have an increasingly ageing and fragile population. It is estimated that there will be a 53% increase in the population over 65 by 2039[5]. There is also a growing proportion of our population who are considered overweight or obese. Around two-thirds of NHS Grampian is considered overweight or obese, with a 46% increase in those with a BMI of 40+ from 2012 to 2016[6]. This is reflected in the experience of the colorectal service in Aberdeen Royal Infirmary with two thirds of patients have a BMI of >35 and one third of this cohort a BMI >35. The increase in these vulnerable groups makes either open or laparoscopic surgery for urgent or time critical conditions more likely to be associated with an adverse event.

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[4] Kowalewski K.F, et al. Functional outcomes after laparoscopic versus robotic-assisted rectal resection: a systematic review and meta-analysis. Surgical Endoscopy. 5 February 2020.

[5] Scottish Government (2016). *Beating Cancer: Ambition and Action.* P.9

[6] NHS Grampian (2019). *Obesity, it's time to talk: Director of Public Health Annual Report 2018-19.* p.14

In addition, cancer is an ever growing cause of death for individuals in Scotland. Approximately 32,000 people were diagnosed with cancer in 2013 and this is expected to reach 40,000 between 2023 and 2027[7]. This increase results in a larger cohort of patients requiring complex surgeries, some of which are not possible with traditional surgery. The introduction of robotic surgery has not increased the number of patients that can access intervention but by minimising surgical trauma improved clinical outcomes. This in particular is of note when patients enter the surgical phase compromised from prior chemo-radiotherapy treatments.

The key population groups directly affected by the development of RAS services in Grampian are summarised in table below.

Population Groups (Directly Impacted via RAS)	
General Surgery	Adults accessing colorectal cancer surgery (Grampian plus complex cases from Orkney and Shetland)
	Adults accessing hepatic, pancreatic and biliary (HPB) surgery (Grampian, Orkney and Shetland)
	Adults accessing upper gastrointestinal oncological resection surgery (Grampian, Highland, Orkney & Shetland)
Urology	Adults accessing radical prostatectomy(Grampian, Highland, Orkney & Shetland)
	Adults accessing cystectomy (Grampian, Highland, Orkney & Shetland)
	Adults accessing partial/full nephrectomy (Grampian, Highland, Orkney & Shetland)
	Adults accessing pyeloplasty (Grampian, Highland, Orkney & Shetland)
	Adults accessing adrenalectomy surgery (Grampian, Highland, Orkney & Shetland)
Orthopaedics	Adults accessing knee/hip joint replacements (Grampian only)
	Adults accessing surgery for orthopaedic tumours (Grampian. Highland, Orkney & Shetland)
Gynaecology	Women accessing hysterectomy (Grampian, Highland, Orkney & Shetland)
Future Population Groups Likely to Benefit from RAS - individuals requiring endocrine/adrenal surgery and patients requiring shoulder replacement.	

Table 2: Population Groups Impacted via RAS

The expansion of robotic surgery will also bring opportunities and challenges to a range of clinical teams (surgeons, anaesthetists, trainees, surgical ward staff and specialist nurse and allied health practitioners) in:

- General Surgery
  - Colorectal
  - Upper GI Surgery
  - Hepatobiliary
  - Endocrine
  - Complex hernia and abdominal wall reconstruction.
- Urology
- Orthopaedics
- Gynecology

[7] Scottish Government (2016). *Beating Cancer: Ambition and Action.* P.9

Co-dependent services:

- Theatres - training of theatre staff and creation of theatre co-ordination capacity to support effective and efficient delivery of surgical sessions. This will be facilitated as the original robot will be used primarily for education and training.
- Imaging – For Orthopaedic implant surgery on the Mako robot, patients are required to have a CT scan approximately 4 weeks in advance of their surgery (this is not required for procedures performed on the DaVinci robot). This will require equivalent of 1.5 hours of band 5 time. Reporting of the CT scans by a radiologist will not be required as they are planning scans only. The greater precision and accuracy of prosthetic implants is expected to improve revision rates and offset some of this additional activity.
- Decontamination – an additional Sterrad unit and an ultrasound washer are required to ensure that the decontamination service can deliver the increased throughput of specialised instruments arising from the second DaVinci robot in General Surgery and the Mako robot in Orthopaedics, in line with the current agreed 24 hour turnaround standard for Da Vinci instrumentation (6 hours for fast track items). The additional equipment also improves resilience by doubling the number of units capable of cleaning the robotic instruments and avoiding the need to send instruments down to Newcastle for sterilisation during periods of down time e.g. planned maintenance periods or in the event of breakdown. There is no requirement for additional decontamination staffing as the activity is offset by reduced decontamination of existing instrument sets supporting laparoscopic and open surgery.
- Critical Care – evidence from other centers shows that a reduction in open/conversion to open surgery will reduce the demand on ICU/HDU beds.

2.4.4. Drivers for Change

In addition to the strategic drivers, there are a number of drivers for change which have been identified locally which are also consistent with those set out within the National Framework for RAS.

- Timely, person centred care
- Continuously improve and maintain patient clinical and health outcomes
- Improved equity of access and reduction in the health inequalities gap
- Continued safety of patients and staff
- Time and capacity required for quality training of surgeons
- Need to be innovative due to capacity and resource limitations
- Reduction in Unwarranted Variation
- Impact of COVID has resulted in reduced capacity and productivity for surgical services for a number of reasons including competitive allocation of scarce health care resource such as critical care facilities. RAS allows alternative pathways to be considered.
- Services, such as orthopaedics have optimised their threshold in productivity linked to enhanced recovery – evidence shows that introduction of MAKO Robot in orthopaedics would significantly reduce length of stay in hospital further supporting flow and capacity within the ward.
- Historical recruitment and retention challenges in Grampian which has depended on increased use of agency/locum staff

- Finite people, skills and resources, therefore critical all are used optimally to maximise health outcomes for the population
- Supports a collegiate approach to surgical pathways across the region offering new and more sustainable ways of collaborating.
- Service Sustainability – linked to above points

2.4.5. Current Service Provision and Arrangements

General Surgery

The General Surgical Department at Aberdeen Royal Infirmary comprises of 19 Consultant General Surgeons with a specialist interest in 1 of the four surgical subspecialties of Upper Gastrointestinal (GI), Colorectal, Hepato-pancreatico-biliary (HPB) and Endocrine surgery. From this well complimented team, 13 Full Time Consultants (4 Upper GI, 5 Colorectal, 4 HPB, 1 Endocrine) have a very high uptake of minimally invasive laparoscopic surgical approach for several years with an established proficiency.

Newly appointed colleagues have also had previous training to a high standard in the laparoscopic approach and also bring a significant level of clinical and research expertise regarding RAS. Therefore, the department boasts of a good profile of skill mix and procedures in each subspecialty and routinely performs minimally invasive surgery including complex oncological procedures. The team have a strong track record in training and research and established academic links.

The service workload is outlined below.

a. Colorectal:

   Oncology

   The Colorectal service maintains a prospective database and boasts of a yearly case load in excess of 300 cancers thus making it a high volume centre. These cases are frequently complex presentations with locally advanced disease requiring a high level of skill and expertise on the part of the multi-disciplinary team (MDT) in terms of case selection for curative or potentially curative treatment. The most challenging patients in NHS Grampian are similar to those nationally, namely, male patients with a narrow pelvis, high BMI and low rectal disease. Annually, around 100 of these patients undergo operative intervention currently at NHS Grampian. While the focus remains at sphincter preservation and the team are working towards delivering complex procedures. The avoidance of a stoma and the use of appliances over many years has patient, clinical, economic and social benefits – the economic benefits accrue and become significant over time. Over and above this, there is scope for extending the possibility of surgical resection to a wider group of patients through the availability of precision surgery and improved function. There is also the potential for attempting a more radical surgical approach known as complete mesocolic excision for patients with right sided/colonic cancers with a view to improving their disease-free survival which is often poorer compared to rectal cancer. With the already available expertise in robotic cystectomy and hysterectomy, building up the expertise in RAS rectal surgery would allow a collaborative team of urologist, gynaecologist and colorectal surgeon to take the lead in Scotland to offer

patients robotic pelvic exenteration. Part of our aspiration is to develop NHS Grampian as 'the centre' for robotic complex pelvic surgery in Scotland.

Non-Oncological

The service also provides a wide range of operative procedures for complex Inflammatory Bowel Disease (IBD), diverticular disease, pelvic floor and functional bowel disorders performing in excess of 100 cases annually combined.

b. Hepato-Pancreatic Billary surgery (HPB): The HPB service is a tertiary service which specializes in Hepatic, Pancreatic and Biliary surgery including oncology. The Hepatic service provides support for patients with Colorectal cancer related liver metastases which are suitable for curative resection. The current annual case load is approximately 20 Whipple's procedures, 20 distal pancreatectomy, 20-30 Liver resections and around 5-10 splenectomies. The current laparoscopic rate is around 30% for liver resections and distal pancreatectomies and around 80% for splenectomies. Collaboration with other centres in the North of Scotland with a trend towards regional delivery may double the workload in the near future under the umbrella of the North Cancer Alliance (NCA).

c. Upper GI Surgery: The Upper GI service is also a tertiary service with a case load of around 20 oesophageal resections annually. This number may increase to 30 with the regionalisation of the service this year so that the resections from NHS Highland are also referred to NHS Grampian. Beside oncology, the service also provides a complex hiatus hernia service performing around 40 procedures annually and a bariatric surgery service performing around 40 cases annually including complex redo procedures.

d. Endocrine: Currently on average, every year, NHS Grampian performs about 10-12 resections for benign and malignant primary and metastatic tumours of the adrenal gland. Besides the above workload, the service also delivers a complex hernia and abdominal wall reconstruction service. This work is predominantly generated from oncology patients having undergone complex abdominal surgery either electively or on an emergent basis.

Table 3 overleaf summarises the annual oncological and benign workload at Aberdeen Royal Infirmary. The data for the colorectal work has been extracted from a prospectively maintained database and is therefore an accurate reflection of the workload.

Specialty/Pathway	Description	Number of cases
Colorectal/Oncology	Colorectal Cancer cases	324
	Rectal Cancer cases	100
Colorectal/Benign	IBD/Diverticular disease/Functional	100
Upper GI/Oncology	Oesophageal Cancer	30
Upper GI/ Benign	Complex Hiatus Hernia	40
	Bariatrics	40
HPB/Oncology	Whipple's procedure	20
	Distal Pancreatectomy	20
	Liver resections	30
HPB/Benign	Splenectomy	15
	Complex Biliary work	Unestimated but possibility
Endocrine/Oncology	Adrenalectomy	10
Other Benign work	Complex Abdominal Wall Reconstruction	20-30

Table 3: Annual Oncological and Benign General Surgical Workload

Orthopaedics

The work of this department includes the management of all patients requiring elective or emergency Orthopaedic treatment. The Department covers an area from roughly halfway between Dundee and Aberdeen to partway between Elgin and Inverness and including the Orkney and Shetland Islands. Close working exists between the Orthopaedic Departments in Aberdeen and Elgin where five Consultants are based. The population of the area is approximately 530,000.

Orthopaedic specialities include foot and ankle, hand, upper and lower limb, spinal, tumour and paediatrics. The department boasts of a good profile of skill mix and procedures in each subspecialty. The team have a strong track record in training and research and established academic links.

Orthopaedic services have been reconfigured in Aberdeen according to the recommendations of the Acute Services Review. Aberdeen benefits from trauma and elective services being based on two different sites. This allows both trauma and elective patients to be treated in specialised Units. Aberdeen was the first centre in Scotland to receive major trauma centre status.

During 2019, the service undertook:

- 42,625 out-patient appointments (2,096 virtual)
- 16,631 Adult Trauma
- Adult Elective: 21,633
- Paediatric Trauma: 1,797
- Paediatric Elective: 2,564
- 3,847 in-patient procedures at Woodend Hospital
- Provision of on-call rotas for adult trauma, major trauma centre, shared hand trauma, shared spine, paediatric at Aberdeen Royal Infirmary and in Elgin

The service currently has 27.5 WTE substantive consultants, 5 WTE substantive consultants in Elgin and 1.0 WTE General Practitioners with a Special interest.

2.5 Investment Objectives

The objectives of this proposal are consistent with those principles as set out in NHS Grampian's Acute Sector Strategic Plan, the Grampian Clinical Strategy and Remobilisation Plan.

1. Safe, person-centred and outcome focused care
2. Staff health, wellbeing and safety
3. Improved effectiveness and efficient care
4. Tackling inequalities
5. Developing a sustainable workforce

2.6 Benefits

A wide range of benefits have been set out in this section. Figure 4 provides a high level summary and Appendix 4 sets out the tangible benefits, along with the potential impact and the measures to monitor realisation of these against the investment objectives.

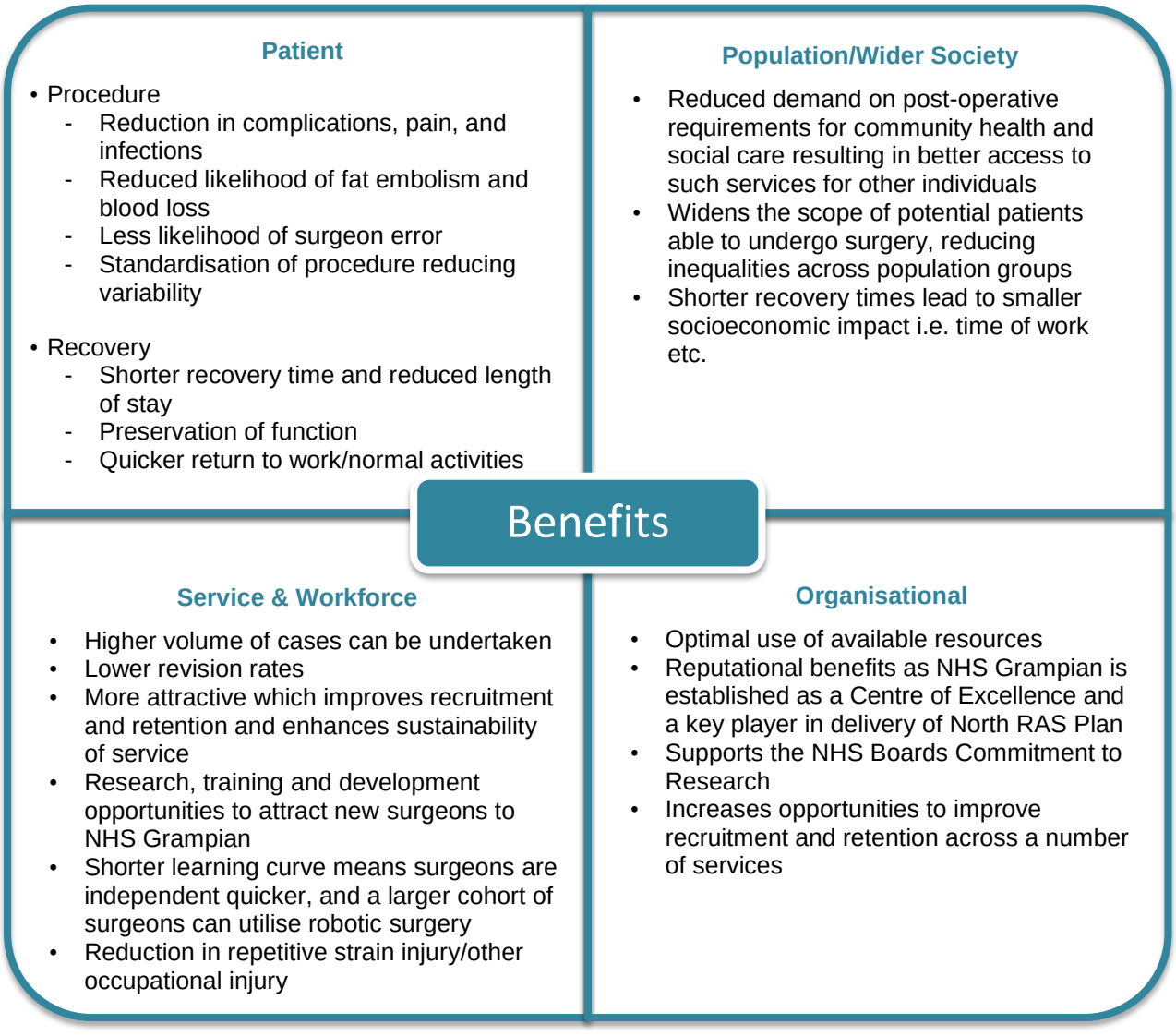

Figure 4: Summary of Benefits of the Business Case

2.6.1 Clinical Outcomes

Clinical outcomes can be classified as patient related and non-patient related (service-related and team-related). Robotic surgery presents several outcome benefits encompassing both of the above. For the purposes of a lucid read, the outcomes have not been further sub-classified but their remit included in brackets to indicate the domains they encompass.

i. Wider uptake of MIS (minimally invasive surgery): Currently MIS is offered via the laparoscopic approach. It is well documented the learning curve for laparoscopic surgery is quite steep. The rate of laparoscopic colorectal cancer surgery in the UK is around 50%, however, this sits at 29% in Scotland. The Grampian rate for laparoscopic colorectal procedures sits at 33%. Other intra-abdominal procedure for HPB cancers and UGI cancers is even lower. In fact, certain procedures like cystectomies (urology) do not lend themselves to the laparoscopic approach at all. The robotic platform presents the advantage of a shorter learning curve[8] [9]compared to laparoscopic surgery and therefore allows for widening the uptake of MIS in two different ways as below:
    - **Widening the patient population suitable for MIS** (patient related): The technical ease provided by robotic surgery will enable more complex and higher risk patients to be offered MIS thus increasing the rate of MIS in Grampian. It is anticipated that in the first year after the technique is embedded in clinical practice, the rate of MIS should increase to at least over 50% from the existing 33%.
    - **Widening the surgeon cohort able to offer MIS** (team, patient and service related): Due to the shorter learning curve and more intuitive functionality, thus passing on the benefit of MIS to their patient population. In the longer run, this should help with improving the MIS rates in Grampian to as high as 80% accepting a cohort of patients who have had previous complex intra-abdominal surgery and therefore not suitable MIS at all.

ii. **Reduction in length of stay** (service and patient related): The benefit of a reduced length of stay subsequent to MIS is well established[10] [11]. If the MIS rate is improved to above 50%, this will automatically impact across the hospital bed capacity and bed-management.

iii. **Reduction in post-operative complications** (service and patient related): There is published evidence to suggest a reduction in post-operative complications in patients offered a robotic approach for their procedure.

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[8] Chang Y et al. Robotic-assisted Laparoscopic Radical Prostatectomy From a Single Chinese Center: A Learning Curve Analysis. Urology. 2016 Jul;93:104-11.

[9] Kim Ik et al. Is prior laparoscopy experience required for adaptation to robotic rectal surgery?: feasibility of one-step transition from open to robotic surgery. *Int J Colorectal Dis* 29, 693–699 (2014).

[10] Guillou PJ et al. Short-term endpoints of conventional vs. laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet.* 2005; 365: 1718-1726

[11] Carbonell, A et al. Reducing Length of Stay Using a Robotic-assisted Approach for Retromuscular Ventral Hernia Repair, Annals of Surgery: February 2018 - Volume 267 - Issue 2 - p 210-217.

iv. **Reduced utilisation of critical care beds** (predominantly service related): With an improved rate of MIS and reduced post-operative complications and length of stay, there will be a reduction in access of critical care beds.

v. **Better theatre utilisation and potential reduction of operative time** (service related): Robotic surgery offers the potential for standardisation of the operative technique across the cohort of surgeons and the operative team thereby potentially standardising the operative time. This will allow for better prediction and theatre utilisation with a possibility for increasing theatre utilisation. Moreover, once embedded, robotic surgery allows for reduction in operative time for straight forward procedures.

vi. **Preservation of function** (patient related): A frequent and significant complication of colorectal cancer surgery is a compromise in the functional outcome for the patient. This may be in the form of a stoma or a loss of bladder/bowel control or difficulties with sexual function. These complications have significant emotional and economic implications negatively affecting the patients' post-operative quality of life. Robotic surgery offers the ability for precision dissection to preserve the nerves resulting in the above complications thus preserving patients' quality of life as well as allowing for restoration of bowel continuity and preventing stomas.

vii. **Occupational risk reduction** (team related): There is evidence to suggest a reduction in repetitive strain injury as well as back and neck injuries associated with laparoscopic surgery in surgeons adopting robotic surgery due to the ergonomic design of the platform. Also there is anecdotal evidence to suggest that there is less emotional fatigue and stress on a robotic platform compared to the laparoscopic or open approach.

2.6.2. Economic Outcomes

Each of the outcomes listed above present with an opportunity for improvement of health outcomes and avoidance of harm as well as opportunities to reconsider how some resources are used for the benefit of other patients. Aspects not covered above include the benefit of future proofing our services through access to robotic surgery, allowing for retaining and attracting services during centralisation and therefore the associated economic implications. The cost-effectiveness of robotic surgery is not robustly demonstrated in the literature. A comprehensive impact analysis will be undertaken by the Acute Sector in parallel to the introduction of this enhanced service to understand the real world impact of this technology and to ensure unintended consequences are realised and mitigated.

Areas where cost variance can be mitigated include;

a. Workforce

Recruitment and Retention

A key financial challenge for the Board is to reduce our dependency on temporary agency staffing across a range of hard to fill specialised roles. Two of the areas that have struggled to recruit and where the utilisation of agency cover is high, are General Surgery for consultant medical staff and Theatre Nursing. It is anticipated that RAS will significantly improve recruitment and retention in some of our key

medical surgical and theatre nursing roles with a consequential reduction in expenditure on agency staff.

There is growing evidence, from recent efforts to recruit consultant surgeons and skilled theatre nurses, both locally and in other Boards, and also recent enquiries from skilled professionals interested in some of our key nursing roles, that guaranteed access to RAS within a structured professional training and development programme is a key consideration in the decision to accept a job offer.

It also follows that this will be a key factor when staff in these key roles decide to remain employed within Grampian. Surgeons in the early part of their careers increasingly wish to embrace RAS to ensure their skill set matches that of their UK and global counterparts and where surgeons have undertaken fellowships or training in RAS and are fully qualified, but unable to utilise these skills, they may decide to move to enable them to work in more modern surgical settings.

In 2019/20 expenditure on agency theatre nursing was £1.8m (£1.6m in the main theatre suite at Aberdeen Royal Infirmary and £0.2m in the Orthopaedic theatres at Woodend) and expenditure on locum agency medical staff in General Surgery was £1.5m (£0.9m at Aberdeen Royal Infirmary and £0.6m at Dr Grays Hospital).

The following table details the marginal saving that will accrue for each vacancy that is filled with a permanent Board employee rather than an agency staff member:-

W.T.E	Consultant £000's	W.T.E	Theatre Nursing £000's
1.0	105	1.0	40
2.0	210	2.0	80
3.0	315	3.0	120
4.0	420	4.0	160

Table 4: Marginal Savings Permanent Appointment versus Agency/Locum Cover

Training

Typically a surgeon is considered experienced and able to operate independently using RAS after circa 50 supervised procedures (compared to circa 200 supervised procedures for laparoscopic surgery). This benefit is evidenced within our Urology service which went from 1 trained laparoscopic prostatectomist on implementation of RAS to 5 fully trained robotic surgeons offering the full gambit of minimally invasive urology within six months. For each surgeon that would require training in laparoscopic surgery, where we have the ability instead to train them locally and give them the access to perform their theatre list on RAS therefore, we create capacity in the surgical team to reduce the waiting list by circa 150 procedures.

b. Patient Experience

Reduced operating times and improved accuracy allow a quicker recovery with less pain, an ability to get back to normal activity faster and lower complication and re operation rates with better long term outcomes.

c. Reduced Length of Stay

In addition to the obvious benefits to the patient from a reduced hospital stay there is a significant productivity benefit. On average a RAS procedure will reduce the length of stay in hospital by 0.5 days compared to traditional laparoscopic or joint replacement surgery. In Orthopaedics the accuracy of the RAS system will also allow surgeons to significantly increase the number of partial knee replacements performed instead of total knee replacement with a further reduction of 1 day length of stay in hospital. In General Surgery the accuracy of the RAS system will allow operations to be performed on certain patients that, where presently, the only options are open surgery or other treatment options and this will also mean a reduced stay in hospital for some of these cases.

The estimated impact of these productivity improvements can be summarised as follows:-

Speciality	Activity (Cases)	Reduced LOS (Bed Days)	Reduction in waiting list (cases)	Indicative direct cost (£000's)
Orthopaedics	675	562	112	427
General Surgery	450	225	72	188

Table 5: Impact of Productivity Improvements Split by Specialty

Notes:

- Indicative direct costs based on direct cost per case published in NHS Scotland Hospital cost returns (excludes fixed overhead costs).
- Average length of stay assumed as 5 days Orthopaedics and 3 days General Surgery.

d. Other Efficiency and Productivity Benefits

As explained above there is little evidence available in the form of randomised control trials that will help us quantify the efficiency and productivity impact of RAS. What is certain however from the evidence that is available to us, including our own experience in the Urology service, is that the increased accuracy of the technology will deliver significant benefits to the patients care journey and in turn this will bring cost savings both long term due to improved QALYs and short term reduced direct costs for many cases in one or several of the following areas:-

- Reduced wound size – and associated complications from larger wounds.
- Anaesthetic/operative time reduction.
- Improved recovery postoperative from reduced physical debilitation from large wound etc.
- Reduced blood loss (bloodless field).
- Reduced risk of surgical complications – such as incision of blood vessel or nerve – due to enhanced optics from magnification, but also fluroroscopy (where tissues not visible are shown up in colour on surgeons screen).

- Reduced post operative complications from the above surgical complications – e.g. nerve sparing that can prevent complications such as impotence or incontinence and psychological positives of such.
- Improved margin clearing – linked to enhanced optics, angle enhancement (as RAS system manipulates tissues to allow surgeon access rather than second medic retracting from an opposite angle), bloodless field, RAS tools providing improved ability to finely remove tissues to more detailed precision.
- This may lead to reduced need for secondary treatments such as chemotherapy or radiotherapy.
- Absence of a permanent stoma.
- Reduced need for patient to go to HDU/ITU due to reduced surgical complications -combined MIS positives and RAS positives.
- Reduced number of cases requiring early revision, resulting in less patient morbidity and efficiency savings to NHS Grampian.
- Standardisation of techniques making them more cost predictable

2.6.3. Education and Training

With the availability of an established robotic service both for orthopaedics and general surgery, there will be a significant opportunity to establish NHS Grampian as a training centre of excellence. There are a number of key elements of this as below:

a. Training centre for national and international courses: Organising robotic training courses for various procedures to a wide audience at a regional, national and international level
b. Establishing as a proctoring centre with industry: Once our team are well trained then as early as 18 months into the programme, it may be possible for some staff to take up proctoring. This generates revenue from industry for the organisation.
c. Training for trainees:
    - Robotic fellowships: For peri-CCT trainees
    - Embedding robotic training in deanery curriculum at core and higher surgical training level. We would be the first centre to offer this level of focused training if we were to embed modules in early years of training. The clinical team are exploring a curriculum to this effect and it is proposed that the decommissioned Da Vinci robot used by urology will become a training robot.
d. Training of robotic co-ordinator and theatre staff teams in the management and troubleshooting of the robot.

2.6.4. Research

The team are already well placed on the academic front having started feasibility work in areas of unmet need. Through our representation on the Scottish RAS Review Group, the team are ensuring participation in National research work. Once the service is rolled out, it will present numerous opportunities for research with an expectation that partnership with the University of Aberdeen will co-create a Robotic Research Centre. Networking links are already established to this effect with the Health Services Research Unit of the University of Aberdeen. Three recent consultant appointments each bring research and clinical skills from training fellowships and higher degrees.

The team are also involved with the Data Subgroup of the Scottish RAS Review Group tasked to develop a project around setting up a Scottish Robotic Registry. This will further contribute to the delivery of the shared vision of NHS Grampian and partners as set out in 'Our Commitment to Research 2019-2023' published in February 2019.

2.6.5. Reputation

The surgical team will build on its current credibility and reputation with the University of Aberdeen to establish a Centre of Excellence in Training and Research for Robotic Surgery at Aberdeen Royal Infirmary. This will increase our attractiveness as an employer and positions the organisation as ~~a~~ forward thinking. This will directly impact recruitment of high calibre staff as well as retention of staff and service sustainability. This will benefit not only NHS Grampian but the region more widely and build on the close links already established.

2.6.6. Benefits Relating to the Mako Robot for Orthopaedic Surgery

In addition to the benefits outlined in previous sections, there are a number of specific benefits relating to the Mako robot for hip and knee surgery which are summarised below. Appendix 5 contains further detail and evidence.

- Reduced post-operative pain
- Reduced risk of fat embolus (for total knee arthroplasty)
- Reduced length of in-patient hospital stay – natural evolution of our journey since 2017 to improve patient experience and reduce length of stay
- Shorter recovery at home
- Earlier return to work for those of working age (~45% of patients), reducing burden of osteoarthritis to society as a whole
- Increased chance of being suitable for partial knee replacement (for those with knee osteoarthritis), with associated higher patient satisfaction
- Approximately 560 bed days/year freed up to treat other orthopaedic patients
- Improved staff recruitment and retention with early adoption of new technology – only one other Health Board in Scotland has Mako robot (GJNH). Our geographical isolation makes this critical in encouraging surgical fellows and other colleagues to work in Grampian.
- Significant research opportunities
- Reduced number of cases needing early revision, resulting in less patient morbidity and cost-savings to NHS Grampian. Even a modest reduction in revision cases of 1 – 2 per year due to anticipated decreased hip dislocation rates would result in cost savings of approximately £30,000 - £50,000.[12] [13]

[12] Vanhegan I.S, et al. A financial analysis of revision hip arthroplasty – The Economic Burden in Relation to the National Tariff. J Bone Joint Surg Br 2012;94-B:619–23.

[13] Kallala R.F, et al. Financial analysis of revision knee surgery based on NHS tariffs and hospital costs – Does it pay to provide a revision service? Bone Joint J 2015;97-B:197–201.

2.6.7. Benefits Relating to the Da Vinci Robot for General Surgery

In addition to the benefits outlined in previous sections, there are a number of specific benefits relating to General Surgery which are summarised below. Appendix 6 contains further detail and evidence.

- Smaller incisions and greater precision entailed in robotic surgery results in a reduced complication rate, reduced likelihood of surgical related trauma, less blood loss and less likelihood of surgeon error.
- Reduced revision rate, reduced pain and risk of infection leading to shorter recovery and reduced length of stay.
- A subset of colorectal cancer patients with locally advanced +/- low rectal cancer who would benefit from sphincter preservation surgery enabling them to potentially avoid a lifelong stoma as well as improve their disease-free survival through a more precise and comprehensive resection.
- Reduced serious post-operative morbidity in turn translates into a reduced length of stay and less rehabilitative cost post-operatively.
- Perform a higher number of oncologically complete resections with greater ease and in due course shorter operating time and potentially provide gut continuity and sphincter preservation.
- Long term cost saving due to improved QALYs from the absence of a permanent stoma. On average, the length of stay for rectal cancers alone could be reduced by a minimum of 2 days.
- Improved recruitment and retention with adoption of robot – this will help attract high calibre surgeons, trainees and specialised theatre staff to the North of Scotland and will act as a draw to Clinical Fellows and for research.
- Bring significant opportunities for research - building on current expertise in clinical research and be best placed to lead on future research in this emerging field.

2.6.8. Benefits Relating to Replacement of the Da Vinci Robot for Urology

In addition to the benefits outlined in previous sections and evidenced in Appendix 2, there are a number of additional benefits relating to Urology which are summarised below.

- The newer system offers further integration with the theatre system compared with the older Si system to reduce further operative times in more complex procedures like cystectomy and nephro-ureterectomy.
- The newer docking system will also reduce docking time for the robotic system and improve throughput.
- The add-ons available with the newer system will allow radiological image overlay real time and intra operative robotic ultrasound to improve accuracy (improve cancer outcomes) and reduce blood loss.
- Replacement of the existing urology platform to a similar one to general surgery will offer future proofing for the service as well as allow a more streamlined utilisation of available slots by services utilising RAS.

2.6.9. Benefits Relating to Gynaecology

In addition to the benefits outlined in previous sections, there is a possibility of increased access to RAS for gynaecology patients and the possibility of expanding the remit of their work to more complex procedures. The team offer a regional service for ovarian cancer as well as for endometriosis and there is potential to develop a multidisciplinary RAS service in these areas.

2.6.10. Benefits Relating to Decontamination Service

As a result of delivery of this proposal, the necessary investment in the decontamination service for the additional capacity required for processing the workload generated by the additional two robots, would also assist in providing greater resilience to wider services accessing the decontamination service. This would also limit the requirement to access the service in Newcastle which is the current arrangement.

2.7 External Factors are Influencing this Proposal

The main external factors to NHS Grampian influencing the proposal are:

- Historical and increasing challenges in recruiting to medical posts in Grampian and the North of Scotland, which is a greater challenge than other parts of Scotland and UK.
- NHS Scotland ambition for expansion of RAS across Scotland as evidenced in the National Framework for RAS (see Section 2.2), along with national funding made available to support progression of this.
- National and regional support for the further development and expansion of RAS in the North and wider Scotland to support equitable access and outcomes.

2.8 Key Service Risk to Delivery of the Project

Risk/Constraint/Dependency	Mitigation
Access to theatres will be limited in the short term due to theatre workforce capacity challenges.	Theatre capacity for robotic surgery will be prioritised based on clinical need and available workforce. Theatre workforce and training plan is in place. Theatre access/capacity will be scaled up as staff are recruited/ trained as the theatre workforce plan is implemented.
Enhanced infection protection and control measures associated with COVID-19 will reduce throughput of each case.	Orthopaedics - Woodend Hospital is where all elective activity occurs and is a green site. All patients are screened and treated as non-COVID patients.
Clinical prioritisation of resources and capacity for priority 1 and 2 cases reduces the elective theatre sessions available for orthopaedics as part of wider organisational COVID response.	Orthopaedics - Woodend is a separate hospital, as such any emergency work is carried out in Aberdeen Royal Infirmary.

Risk/Constraint/Dependency	Mitigation
Given current COVID pandemic, there is an increased risk that staff leading on/key to delivery may be required to re-deployed or may be absent.	Orthopaedics - staff work in a green site but will be allocated to priority areas based on clinical need.
Data protection - SSP and data protection agreements require to be in place between NHS Grampian and providers.	Work has started with relevant teams in NHS Grampian (service, ehealth and providers). A taskforce is focusing on this.
CT service do not have the capacity to deliver the 15 CT scans/per week as part of the orthopaedic pathway	Agreement in place along with and additional capacity as part of proposal to accommodate the added CT scans for these patients. Mitigation with service creep is provided by the radiotherapy department.
Procurement - The National RAS programme is developing plans for procurement of multiple DaVinci robots in 2020/21	Discussions between the National RAS programme and individual Boards are ongoing. Final agreement on the number to be purchased will impact on the pricing negotiations led by NHS National Procurement. The Board's team are in close liaison with the National Procurement team.
Procurement and availability of the equipment	The suppliers of both the DaVinci and the Mako systems have confirmed that units are immediately available for delivery. The additional decontamination equipment is also available for timely installation.
Funding availability	Capital funding is available to support procurement in 2020/21 and the recurring revenue implications are provided for in the Board's five year financial plan.
Decontamination service is unable to meet the demands/throughput requirements of both robotic and wider services	The decontamination service have agreed an operational plan involving purchase of additional equipment in order to maintain current agreed service levels for processing of the specialist robotic instruments and to improve overall resilience in the service.

Table 6: Summary of Risks, Constraints and Dependencies

2.9 Risks & Impacts Associated with Not Pursuing the Proposal

There are a number of risks and impacts associated with not progressing the proposal. The key areas are highlighted below. These have been based on local learning and experiences, along with experiences and intelligence from elsewhere.

a. *Lack of Attractiveness as a Training Centre*

Most eminent general surgical units across the UK and internationally boast of robotic technology. General Surgery is already in the lag phase of adoption. Further delay is likely to be detrimental to the unit's reputation. Especially since other teams like Urology and Gynaecology at Aberdeen Royal Infirmary

have already adopted the approach. It is fairly difficult to attract high caliber trainees to the North of Scotland and a lack of exposure to contemporary technological advancements further hinders any attempts towards this on the part of the Unit.

b. *Difficulty with Attracting High Caliber Staff*

Similar to the above point, Aberdeen Royal Infirmary loses its attractiveness as a centre for pursuing a competitive career as a surgeon due to lack of access to robotic technology. This also translates in a difficulty with employing allied healthcare professionals especially in theatres.

c. *Loss of Services*

With robotic platforms being acquired by other centers around Scotland, there is a real risk of losing cancer services to these centers from Aberdeen. This would have a very detrimental effect further negating the attractiveness for recruitment and retention. Through our experience of being involved in the Scottish National RAS (Robotic assisted surgery) review and planning group, there is already a push for centralisation of services and access to robotic platforms will be an important aspect of decision making in this process. This would mean that patients in Grampian and wider North of Scotland would require to travel much further for their surgery.

d. *Patient Choice*

Patients are increasingly aware of available treatment choices and would naturally prefer treatment modalities providing a potentially better rate of minimally invasive approach due to the benefits mentioned above. In due course, patients may choose to have their treatment at centers catering to their preferences.

e. Services will not be as efficient or productive and gain the many benefits set out in this case. It will also be a loss of opportunity to make significant progress to RAS which is fast becoming the new norm for surgical delivery.

f. Increased risk of inequity

2.10 Health Inequalities Impact Assessment

A health inequalities impact screening was undertaken using the agreed NHS Grampian health inequalities impact screening checklist – this is contained within Appendix 7.

The assessment has highlighted a few areas for consideration as part of implementation in support of specific population groups.

Overall the assessment highlighted that the proposal does not disadvantage any groups and in fact, improves access to the elderly and those with multiple morbidities who would have been considered too high risk for traditional surgical approaches. Implementation of this proposal will also support increased access for more individuals to surgical care and also to community services within the health and social care system.

2.11 Support for the Proposal

There is significant support for the expansion of RAS:

- Clinicians and staff across a number of services within the Acute Sector
- Acute Sector Triumvirate
- The NHS Grampian System Leadership Team/Chief Executive Team supported the draft Case and the recommendation for submission to the Grampian NHS Board for endorsement.
- Clinical colleagues from NHS Boards within the North of Scotland have confirmed support for the national direction and are working across the region to support the delivery of the National Framework. Chief Executives Group in the north support expansion of RAS aligned to the National Framework

In addition to the above, the proposal set out supports the ambition of the National RAS Oversight Programme Board and the endorsed national framework.

2.12 Conclusion

This strategic case sets out the compelling evidence to seek support from NHS Grampian Board on behalf of the Acute Sector to purchase two additional surgical robots and replace the existing robot utilising the funding made available by the Scottish Government during 2020/21.

3.0 Commercial Case

3.1 Overview

This section outlines the commercial arrangements and implications for the project.

The key commercial component of this project is the procurement of The Da Vinci surgical system for use in General Surgery and Urology and procurement of the MAKO robotic Surgery System for use in Orthopaedics.

The project will also require procurement of an additional Sterrad and an ultrasound washer for the decontamination service and an integrated operating table for the Da Vinci surgical system

3.2 Procurement Strategy

3.2.1. Introduction

The purpose of this section is to specify the procurement strategy and it does this by setting out:

- Procurement Route
- Compliance with EU Regulations
- The Procurement Plan for the Project

3.2.2. Procurement Route

In identifying the procurement approach to be undertaken, the project team considered the following:

- Contract Value (over the initial 5 year period) –
    - The contract value for the Da Vinci surgical system is anticipated to be £7.8m (£3.8m for the initial purchase cost and circa £0.5m per annum per system for maintenance and consumable costs – no maintenance required in first year).
    - The contract for the Mako Robot will be £2.6m (£1m for the initial purchase costs and circa £0.4m per annum for maintenance and consumable costs – no maintenance required in first year).
    - The contract for the operating table is anticipated to be £106k (£90k for initial purchase and £4k annually for maintenance – after year 1), the Sterrad £120k (£100k for initial purchase and £5k annually for maintenance – after year 1) and the ultrasound washer £36k (£30k for initial purchase and £1.5k annually for maintenance – after year 1).
- Scope of Contract – the initial contract will be for the purchase of the equipment with an annual contract thereafter for servicing and maintenance and supply of specialist bespoke consumables.
- Risk – the scope of the contract covers bespoke equipment supply and contains a number of high risk areas including: complex implementation, ongoing performance standards within a healthcare setting where continuity of high quality clinical service is imperative.

- Existing contracts or frameworks:
  - The Da Vinci surgical system for use in General Surgery and Urology is available on an NHS Supply chain framework contract and at present is the only surgical system that offers the evidence based, consistently high standard of precision operating to support more complex surgery.
  - The MAKO robotic Surgery System for use in Orthopaedics is available on an existing NHS Scotland National Framework contract and is the only known Robotic System that is capable of performing Total Knee Replacement, Partial Knee Replacement and Hip Replacement in 3 individual applications housed on one Robotic System.
  - The additional Sterrad and ultrasound washer will require agreement for a single tender procurement arrangement – both are specialist equipment and procurement must ensure technical compatibility with the existing installed equipment base in order to maximise efficiency.
  - The integrated operating table will also require agreement for a single tender procurement arrangement – it is specialist bespoke equipment designed to operate with the Da Vinci surgical surgical system and is only available from a single supplier.

3.2.3. EU Rules and Regulations

As explained above the DaVinci system and the Mako Robotic Surgery system are both available on national frameworks that have previously been subject to competitive tendering processes that comply with the relevant procurement rules and regulations.

Procurement of the Sterrad, ultrasound washer and operating table, will require agreement to proceed as a single tender from nominated suppliers, in line with the Boards standing financial instructions, and on the basis that this action is necessary for reasons of technical compatibility, efficiency, effectiveness and in the case of the operating table this is only available from a single supplier.

3.2.4. Procurement Plan

An outline of the project's procurement plan is described below. This highlights the project's current procurement status, what has already been achieved and what still needs to be done.

Stage	Target Date
Final agreement on specification of equipment	25 November 2020
Complete commercial negotiations with suppliers	7 December 2020
Submission of Business Case to NHS Grampian Board	3 December 2020
Notification of award of contract	7 December 2020
Finalise Data protection and Cyber security arrangements	8 January 2021
Commence implementation and training	15 January 2021
Implementation complete	31 March 2021

Table 7: Procurement Plan & Timeline

3.2.5. Advisors

The procurement process is being led, on the Boards behalf, by NHS National Services Scotland National Procurement specialists.

Legal services, where necessary, will be provided by the NHS Scotland Central Legal Office (CLO).

3.3 Payment Structure

Payment for the equipment will be following installation and user acceptance.

The equipment will be covered by guarantee for the first year and thereafter a servicing and maintenance contract will be payable annual in advance.

Consumables are all payable on delivery.

3.4 Personnel Arrangements

There are no NHS Grampian employees who are wholly or substantially employed on services that will be transferred to the private sector under the proposals for this project, and therefore the Transfer of Undertakings (Protection of Employment) Regulations 1981 (TUPE) will not apply.

4.0 The Financial Case

4.1 Introduction

The Financial Case considers the financial implication of the proposed service arrangements and confirms its overall affordability in the context of the Board's financial plans.

It does this by setting out the financial assumptions for both the revenue and capital costs including affordability and funding availability.

In summary the investment required to deliver the project is set out in table 8 and the revenue implications are set out in table 9.

4.2 Capital Costs

The Capital costs are based on indicative quotes received from Stryker for the Mako robotics system and from Intuitive Surgical for the Da Vinci system.

Capital	Mako Robot Orthopaedics	Da Vinci xi General Surgery	Da Vinci xi Urology (replacement)	Total
Expenditure	**£000's**	**£000's**	**£000's**	**£000's**
Basic System	522	2,039	2,039	4,600
Mako Partial Knee Application	187			187
Mako Total Hip Application	187			187
Mako Total Knee Application	187			187
Additional Instrument Sets	90			90
Operating Table		108	108	216
Additional Scopes		53	53	106
Trays		2	2	4
Total Robotic Surgery Equipment	**1,173**	**2202**	**2202**	**5577**
Decontamination Service				
Larger Height Sink		**12**		**12**
Malmo Wrack System		**7**		**7**
Wash Basket		**2**		**2**
Additional Sterrad		**108**		**108**
Additional Ultrasonic washer		**26**		**26**
Total Decontamination equipment		**155**		**155**
Electrical Infrastructure	**5**	**5**		**10**
Total Capital expenditure	**1,178**	**2362**	**2202**	**5742**
Total available funds	**1,178**	**2,362**	**2,202**	**5,742**

Table 8: Breakdown of Capital Costs

The costs outlined in table 8 have been compiled on the following basis:-

a. All costs include Value added Tax (VAT) at 20%.

b. Investment in an additional Sterrad and ultrasound washer for the decontamination service will ensure that the decontamination service can deliver the increased throughput arising from the additional General Surgery and Orthopaedic services in line with the current agreed 24 hour turnaround standard for Da Vinci instrumentation (6 hours for fast track items). The additional equipment also improves resilience by doubling the number of units capable of cleaning the robotic instruments and avoiding the need to send instruments down to Newcastle for sterilisation during periods of down time e.g. planned maintenance periods or in the event of breakdown. The alternative would be to purchase additional endoscopes and instrument packs at an estimated capital cost of £100k but although this would mitigate the impact on capacity in the decontamination service the resilience issues would remain with instruments regularly requiring to be sent off site.

c. No significant reconfiguration or enabling works are required to accommodate installation of the equipment in either of the operating theatres or within the decontamination service. The above capital cost estimates include a small provision for the installation of additional electrical sockets.

d. The purchase cost of the robots includes initial intensive training for 4 surgeons.

4.3 Revenue Impact

The annual revenue costs, after the first year of operation, are assessed as follows:-

Revenue	Mako Robot Total & Partial Knee and Total Hip	Da Vinci xi General Surgery	Da Vinci xi Urology (replacement)	Total
	£000's	**£000's**	**£000's**	**£000's**
Direct Costs :				
Consumables	310	402	358	**1,070**
Servicing & Maint – Robotics	75	160	160	**395**
Licence fee – Simulator		13	13	**26**
Servicing & Maint – Decontam		10		**10**
Robotic Co-ordinator (2 wte afc7)	0	54	54	**108**
Radiography staffing(0.2wte afc 5)	8	0	0	**8**
Total Revenue Costs	**393**	**639**	**585**	**1,617**
Current service funding				
Consumables		415	470	**885**
Servicing and Maintenance			165	**165**
Robotic Co-ordinator (1wte afc7)			54	54
Total current service costs		**415**	**689**	**1,104**
Net recurring operating costs	**393**	**224**	**(104)**	**513**
Depreciation	**117**	**233**	**220**	**570**
Total recurring costs	**510**	**457**	**116**	**1,083**

Table 9: Breakdown of Revenue Costs

The above analysis of costs has been compiled on the following basis:-

a. Reflects the total cost of consumables for General Surgery - Robotic Anterior Resection using a stapler and without complications compared to current costs for an equivalent Laparascopic procedure, assuming throughput for the robot of 300+ colonic resections and 225 less complex procedures per annum.

b. Reflects the marginal cost of specialist consumables assuming maximum throughput for the Mako robot of 225 total hips, 225 total knees and 225 partial knee replacements per annum.

c. Reflects benefit in Urology from improved life of instruments from the existing 10 uses (for Si configured instruments) to a variable rate between 15-18 uses (for xi and x configured instruments) depending on the instrument type – estimated saving of £112k per annum compared to current costs.

d. Additional Radiography staffing required to support CT scanning as part of pre-procedure treatment with the Mako robot – calculated as 7.5 hours per week afc 5.

e. A Robotic Theatre co-ordinator will be required to assist the surgical team in the system set up and running of the Da Vinci system before and during all scheduled cases and to assist the clinical operating team in the disassembly and cleaning of the system. The model used successfully for Urology is an afc band 7 advanced scrub practitioner (WTE gross cost of £54k per annum). The contract for supply of the Mako Robot will include this service provided

f. Depreciation calculated on a straight line basis over a 10 year economic useful life in line with the Board's accounting policies for non-imaging equipment.

g. Ongoing Maintenance and Technical service cover is based on the indicative quote from the system suppliers, for year one there will be no charge as covered by first year warranty and therefore maintenance costs would apply from year 2 only.

Opportunities to Mitigate Costs

Section 2.6.2 outlines the potential efficiency and productivity benefits which include improved recruitment and retention into key hard to fill clinical roles and the significant reduction in the length of patient stay in hospital. The main benefits that accrue from implementation however, relate mainly to the patients experience - reduced operating times and improved accuracy allow a quicker recovery with less pain, an ability to get back to normal activity faster and lower complication and re-operation rates with better long term functional outcomes. There is a financial benefit associated with these direct clinical benefits but this is more difficult to estimate and extrapolate.

Funding Availability

Provision has been made in the Board's five year financial plan for the above costs associated with this development.

5.0 The Management Case

5.1 The Management Case

This section sets out the arrangements in place to demonstrate that the organisation is ready to proceed to procurement and project implementation and confirm the arrangements in place to successfully deliver the proposal.

Section 2 sets out the compelling case for expanding RAS which provides significant evidenced opportunities to enhance the management of a range of challenges as highlighted in the case for change Section 2.4. The Scottish Government Health and Social Care Directorate have confirmed funding for NHS Grampian to purchase two robots.

5.2 Project Management & Governance Arrangements

The Robotics Surgery Project will follow an agreed project management approach, reporting into the agreed organisation structures as shown in the diagram below.

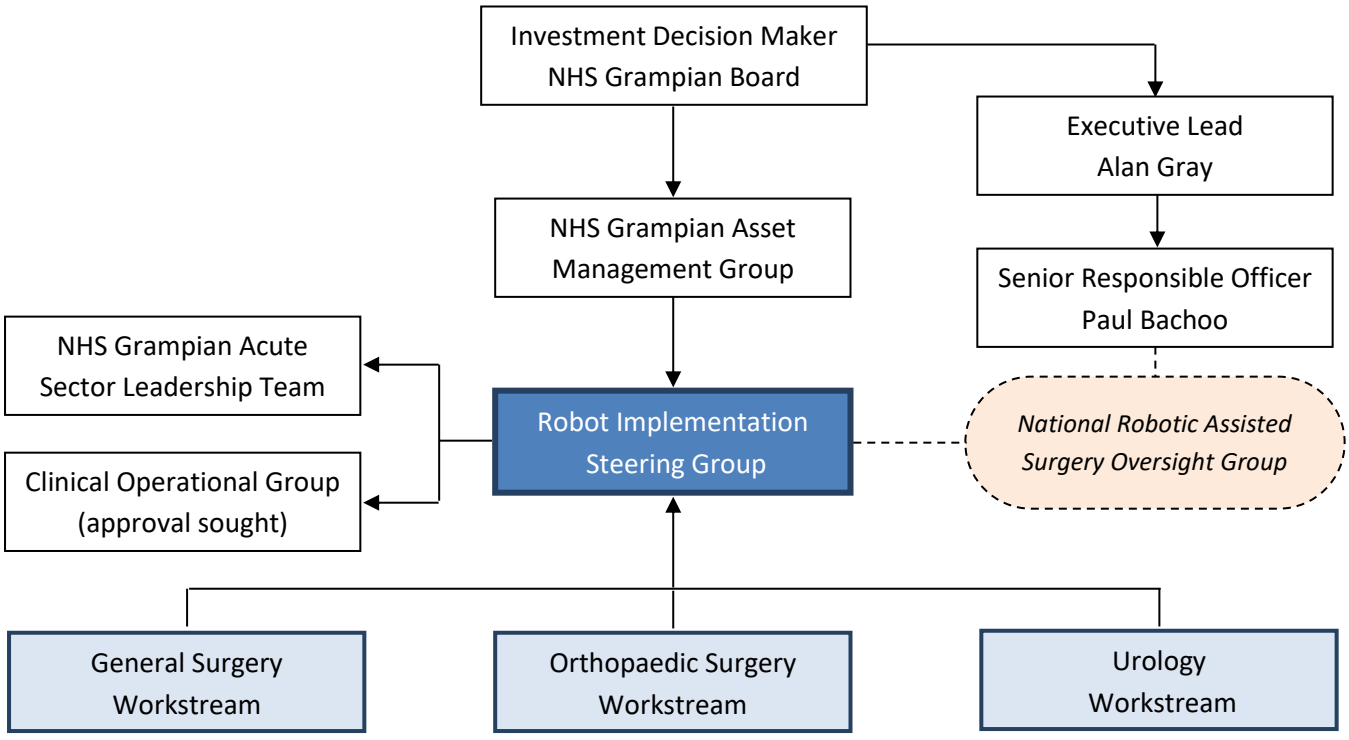

Figure 5: Project Management Structure and Governance Arrangements

The reporting and governance arrangements outlined in figure 5 above indicate the groups who will be involved in providing assurance to the NHS Grampian Board as part of the governance process for the project. Governance routes exist to the Acute Sector Leadership Team and to the Asset Management Group as well as to the NHS Grampian Board.

Advice and any additional governance routes are supplied and accessible through the NHS Grampian organisational structure, offering strategic links with other developments and programmes such as the Baird Family Hospital, the Anchor Centre Project, the Elective Care Programme and the North RAS Implementation Plan.

5.2.1. The Robot Implementation Steering Group

The Executive Lead for this project is Alan Gray, Finance Manager. The Senior Responsible Officer is Paul Bachoo. Cameron Matthew, Interim Chief Officer for Acute Sector, chairs the Steering Group.

A project governance structure is in place managed by the Steering Group, responsible for leading the procurement and implementation of the equipment and for the co-ordination and delivery of the associated service change, in line with the Acute Services Strategy. The Steering Group will operate under the oversight of the Acute Senior Leadership Team and the Board's Asset Management group.

Due to the accelerated timescales for the project and the complexity associated with procurement and implementation across three surgical specialties the Steering Group will consist of a core common membership to support the commercial and financial aspects on a consistent basis but to include specialist involvement split across three specialty specific workstreams, General Surgery, Urology and Orthopaedic Surgery.

The Unit Operational Manager aligned to each of the workstreams will be responsible for development of a detailed speciality specific service and implementation plan for their aligned area. This will include:-

- Training and accreditation of surgeons, other theatre staff and decontamination staff.
- Agreement on clinical governance arrangements including formal agreement from the Clinical Operations Group on new surgical procedures
- CT Validation Protocols including compliance with Ionising Radiation Medical Exposure Regulations (for Orthopaedics)
- Undertake a Data Protection Impact Assessment (DPIA) to ensure that patient data is being held in accordance with the Data Protection Act (2018)
- Identification of patients and communication including development of patient information
- Scheduling of theatre time
- Finalise install date (around first patients scheduled),
- Coordination of delivery, installation and testing on site,
- Coordination of consumables order and delivery
- Monitoring, evaluation and reporting as appropriate

Membership of the Steering Group is as follows:-

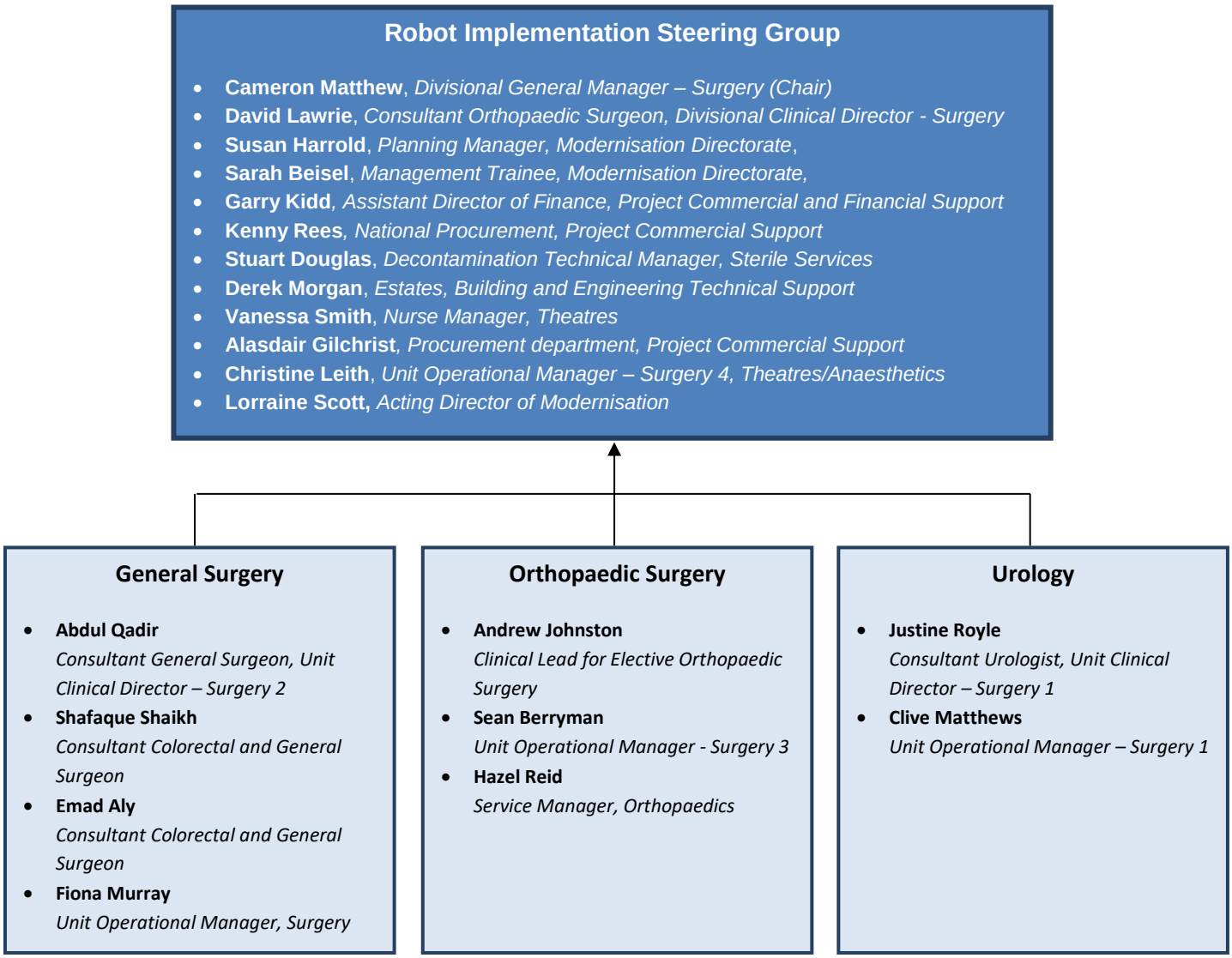

Figure 6: Steering Group Membership

Other experts will be invited to attend the Steering Group meeting as required.

Meetings:

- Administrative support is provided by DGM for Surgery PA
- Meetings are held weekly, subject to review
- Meeting dates have been agreed and set in advance
- The business of the Project Group is recorded in an action note.

5.3 Change Management Arrangements

Clinicians and staff across a range of services have been fully engaged with the whole process from service visioning, planning and have co-produced the Business Case.
Dedicated clinical and management leadership is in place, with involvement of a wide range of subject experts to drive forward the successful service expansion, whilst maintaining existing operational clinical service.

5.3.1. Project Programme

The high level phases and timescales are outlined in the diagram below.

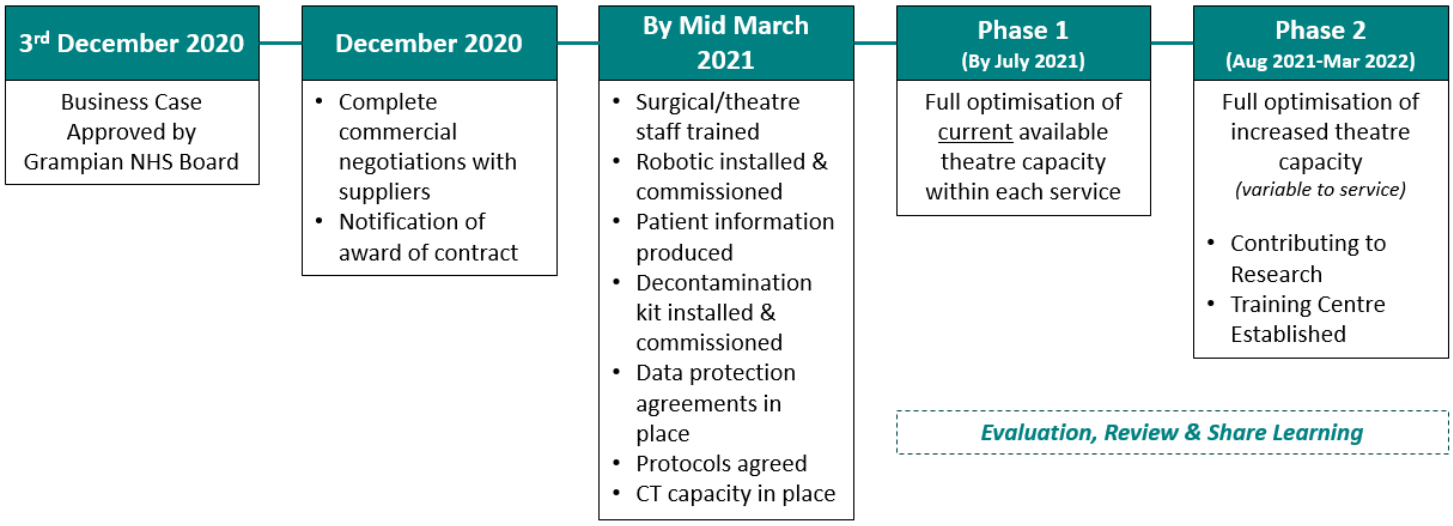

Figure 7: High Level Stages and Timescales for Proposal

The key milestones and anticipated delivery dates are summarised in the table overleaf.

Key Milestones	Date
Board approval	03 Dec 2020
Procurement/contract for robots awarded	07 Dec 2020
Procurement of decontamination equipment	07 Dec 2020
Decontamination equipment commissioned for use	31 Jan 2021
Specifics for Replacement of Robot for Urology	
Delivery and installation of robot	22 Jan 2021
Robot commissioned for use	31 Jan 2021
Update in protocols (linked to replacement robot)	31 Jan 2021
Training undertaken for new robot	31 Mar 2021
Decommissioning/repurposing of old robot for training	31 Mar 2021
Specifics for General Surgery	
Delivery and installation of robot	22 Jan 2021
Robot commissioned for use	31 Jan 2021
Data protection impact assessment undertaken and compliant	8 Jan 2021
Relevant staff trained	Mid Mar 2021
Patient information/package agreed/tested	End Feb 2021
Protocols agreed/tested	End Feb 2021
Evaluation mechanisms in place	Mid Mar 2021
Service Commences	01 Apr 2021
Specifics for Orthopaedics	
Delivery and installation of robot	21 Jan 2021
Robot commissioned for use	31 Jan 2021
Data protection impact assessment undertaken & compliant	Mid Feb 2021
Relevant staff trained	Mid Mar 2021
CT capacity, pathway and protocols in place	Mid Feb 2021
Patient information/package agreed/tested	Mid Feb 2021
Protocols agreed/tested	Mid Feb 2021
Evaluation Mechanisms in Place	Mid Feb 2021
Service commences	01 April 2021

Table 10: Summary of Key Milestones for Project

5.4 Benefits Realisation

The rationale for the investment is demonstrated in Section 2 and a summary of the benefits expected from the project are contained within Appendix 4. Significant work has been carried out as part of the project, to ensure that project benefits are appropriate and viable. Benefits realisation will be monitored throughout the implementation stage, and then evaluated as part of the projects evaluation processes.

5.5 Project Risk Register

Effective management of project risk is essential for the delivery of any project. A robust risk management process and risk register is in place and will be monitored by individual services. Oversight will be provided by the Acute Sector/Steering Group, with implications being regularly examined and escalated via the appropriate governance processes.

5.6 Monitoring & Evaluation

The Service Leads and Unit Operational Manager will be provided with full support from the wider project and operational management teams.

Progress against the Implementation Plan will be reviewed regularly (weekly initially) by the Steering Group. Reports will be provided by the Steering Group to the Acute Sector and Asset Management Group and as appropriate to the North RAS Oversight Group and the National RAS Programme Oversight Group.
Clinical governance will be applied as per routine practice and policies within the Acute Sector.

5.7 Project Evaluation

A number of people are involved in the monitoring and evaluation process which will be overseen by the Steering Group.

An overview of achievement of the project's objectives, evaluation of impact, benefit realisation and learning along with recommendations for any future improvements will be contained within the Project Implementation Monitoring Report.

A comprehensive impact analysis will be undertaken by the Acute Sector in parallel to the introduction of this enhanced service to understand the real world impact of this technology and to ensure unintended consequences are realised and mitigated.