Annual Report 2021/22

Surgical Robotics Program

Sydney Local Health District

6th Edition

CONTENTS

1. Executive Summary

The purpose of this report is to provide a summary of the provision of the surgical robotics program at Royal Prince Hospital (RPA) within Sydney Local Health District (SLHD) for the financial year period 2021/22.

With the first robotic-assisted surgery (RAS) case undertaken at RPA in August 2016, this report covers the sixth financial year of operation for the program.

The surgical robotics program at RPA is one of the broadest multi-specialty public programs in Australia and is truly unique in that it is governed by a comprehensive research framework whereby every patient undergoing RAS is enrolled in a research study, including validated measures of patient-reported outcomes across all disciplines. The use of RAS at RPA is also strongly embedded in ongoing education and training.

Currently there are five surgical specialties utilising the da Vinci Xi Surgical System at RPA including benign gynaecology, cardiothoracic, colorectal, upper gastrointestinal and urology. In addition, the Stryker MAKO Robotic System is being used by orthopaedics in the Institute of Rheumatology and Orthopaedics (IRO) at RPA.

In 2021/22, a total of 119 RAS procedures were completed at RPA including 65 on the da Vinci Xi and 54 on the MAKO system. This resulted in an average monthly RAS caseload of approximately 10 patients. The global COVID-19 pandemic continued to have a significant impact on the 2021/22 program activity with a reduction in the cases able to be performed at RPA throughout this reporting period. RPA has been able to continue providing surgical care to public patients through the establishment of collaborative care agreements between the SLHD and other private hospitals in Sydney. In 2021/22, a total of 67 RAS procedures were undertaken offsite and facilitated through collaborative care bringing the total RAS activity to 186 cases.

The robotic research program continued with the six active surgical specialties contributing to 14 prospective research projects and another seven projects in advanced stages of development. In addition, the team completed eight publications and 12 presentations in 2021/22.

Data, Safety and Monitoring Boards (DSMB) are a critical component of the surgical robotics research program and ensure safety and accountability for the studies being undertaken. The DSMBs are held at key milestones within each protocol with the Boards consisting of key members of the Robotics Research Working Group and an external expert. Two DSMBs were held in 2021/22 involving research projects within urology and orthopaedics.

Credentialing for both senior and junior medical staff was maintained and approved by The Training and Credentialing Working Group throughout the financial year. As of June 2022, there were eight proctors, 20 senior medical staff credentialed, three senior medical staff with interim clinical privileges, five junior medical staff able to operate on the console and 11 junior medical staff able to assist at the bedside credentialed at RPA across the six specialties involved in the surgical robotics program.

The ongoing importance of education and training on the campus remained with the RPA Surgical & Robotics Training Institute (RTI) delivering 15 courses to a total of 22 participants in 2021/22 including surgeons, surgical fellows and theatre nurses. Due to the ongoing workplace safety and travel restrictions set in place resulting from the COVID-19 pandemic and an unforeseen outbreak of Japanese encephalitis virus (JEV) limiting animal movement, opportunities to run face to face training courses were limited, therefore the provision of training during the 2021/22 financial year was significantly lower than previous financial years.

In summary, the surgical robotics program continued to run successfully in 2021/22, despite the ongoing challenges related to COVID-19, and is a credit to the dedication and commitment of SLHD executive, IAS, SOuRCe and the many medical, nursing, allied health and research teams involved.

2. Introduction

2.1 Purpose of report

The purpose of this report is to provide a summary of the provision of the surgical robotics program at Royal Prince Hospital (RPA) within Sydney Local Health District (SLHD) for the financial year period 2021/22.

With the first robotic-assisted surgery (RAS) case undertaken at RPA in August 2016, this report covers the sixth financial year of operation for the program.

2.2 Funding arrangements

Purchase of the latest generation da Vinci Xi Surgical System in December 2015, which was the first within a public hospital in Australia, was made possible through a generous bequest from the late Mrs Shirley Woolley.

The funding for the program is overseen by the New Technology and Specialised Services Committee of NSW Health with the program at RPA currently funded through the standardised activity-based funding (ABF) system allocated through National Weighted Activity Units (NWAU) per case.

3. Governance

3.1 Surgical Robotics Steering Committee

The surgical robotics program is overseen by the RPA Institute of Academic Surgery (IAS) as one of the key programs within its '*Innovation, Value and Thought*' portfolio.

The overarching committee responsible for this program is the *Surgical Robotics Program Steering Committee* which commenced in December 2015 and is co-chaired by Dr Teresa Anderson, Chief Executive SLHD, and Professor Paul Bannon, Co-Chair of the IAS. The committee meets bi-monthly and has representation from Heads of Department and key staff across all clinical departments and areas involved in the delivery of the program.

There are two working groups that report to the steering committee and cover the core functional areas of the program including research, and training and credentialing. The *Research Working Group* meets bi-monthly and is chaired by Dr Scott Leslie, Robotic Research Lead within the IAS. The *Training and Credentialing Working Group* meets quarterly and is chaired by Dr Kim Hill, Executive Clinical Advisor SLHD. The operational aspects of the program are maintained through the *Operating Theatre Management Committee* chaired by Dr Peter Lee, Director of Surgery.

The governance structure of the surgical robotics program is outlined in **Figure 1**.

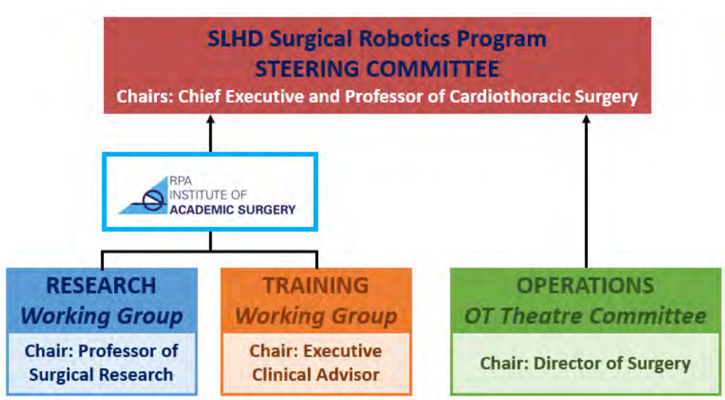


Figure 1. Surgical robotics program governance structure

3.2 Staffing

The delivery of the surgical robotics program at RPA would not be possible without the ongoing commitment and dedication of the many clinical teams and individual staff involved. Their contribution to ensuring the highest level of care is provided to our patients is greatly appreciated. The list of key staff involved in the program are outlined in **Table 1**.

Table 1. Staff involved in the surgical robotics program at RPA in 2021/22	
Management	
Dr Teresa Anderson	Chief Executive and Co-Chair, Surgical Robotics Steering Committee
Mr Kiel Harvey	General Manager RPA
Prof Michael Hensley	Director of Medical Services RPA
Prof Paul Bannon	Co-Chair IAS and Co-Chair, Surgical Robotics Steering Committee
Prof Michael Solomon	Co-Chair IAS and Program Director Surgical Strategy SLHD
A/Prof Ruban Thanigasalam	Robotics Research Lead; Associate Professor of Robotic Surgery
Dr Scott Leslie	Robotics Research Lead; Senior Lecturer of Robotic Surgery and Chair, Robotic Research Working Group
A/Prof Paul Stalley Dr Martin McGee-Collett	Program Director Surgical Operations SLHD
Dr Peter Lee	Director of Surgery RPA
Ms Stella Pillai	Nurse Manager JL Theatres RPA
Ms Kathryn Taaffe	Clinical Nurse Consultant JL Theatres RPA
Dr Kim Hill	Executive Clinical Advisor SLHD and Chair, Training and Credentialing Working Group
Dr Kate McBride	Director IAS, A/Director Surgical Program & Academia SLHD
Ms Mariana Sena Board Dr Sophie Hogan	Associate Director IAS
A/Prof Daniel Steffens	Director SOuRCe
Ms Lucy Mackenzie	Manager Surgical Partnerships IAS
Ms Rosa Fung	Facility Coordinator IAS
Mr Trent Cameron Ms Ruby Masson	Facility Coordinator RTI
Benign Gynaecology	
Dr Sofia Smirnova	Head of Department
A/Prof Michael Cooper	Benign gynaecologist
Dr Trevor Tejada-Berges	Proctor and gynae-oncologist
Dr Vivian Yang	Benign gynaecologist
Ms Milorose Felipe	Clinical Nurse Consultant
Dr Rebecca Taylor	Surgical RMO
Cardiothoracic	
Prof Paul Bannon	Head of Department
Prof Tristan Yan	Cardiothoracic surgeon
A/Prof Christopher Cao	Cardiothoracic surgeon
Ms Lisa Turner	Clinical Nurse Consultant
Ms Lorna Beattie	Clinical Nurse Consultant
Dr Nicholas McNamara Dr Anthony Le	Surgical RMO
Ms Hayley Gibbs	Cardiac Surgery Case Manager

Ms Franchesca Rowshanzadeh	Thoracic Case Manager
Colorectal	
A/Prof Chris Byrne	Head of Department
Dr Peter Lee	Colorectal surgeon
Dr Kirk Austin	Colorectal surgeon
Dr Kheng-Seong Ng	Colorectal surgeon
Orthopaedics	
Dr Jeff Petchell	Head of Department
A/Prof Mark Horsley	Orthopaedic surgeon
Dr Brett Fritsch	Orthopaedic surgeon
Dr Sanjeev Gupta	Orthopaedic surgeon
Dr Richard Boyle	Orthopaedic surgeon
Dr Maurice Guzman	Orthopaedic surgeon
Dr Daniel Franks	Orthopaedic surgeon
Ms Shazia Qureshi	Clinical Nurse Consultant
Upper Gastrointestinal Series (UGI)	
A/Prof Charbel Sandroussi	Head of Department
A/Prof Jerome Laurence	Upper gastrointestinal, hepatobiliary and transplant surgeon
Dr Michael Crawford	Upper gastrointestinal, hepatobiliary and transplant surgeon
Dr David Yeo	Upper gastrointestinal, hepatobiliary and transplant surgeon
A/Prof Carlo Pulitano	Upper gastrointestinal, hepatobiliary and transplant surgeon
Urology	
Dr David Eisinger	Head of Department RPA
A/Prof Lewis Chan	Head of Department CRGH
A/Prof Ruban Thanigasalam	Urologist and Robotics Research Lead CRGH
Dr Scott Leslie	Urologist and Robotics Research Lead RPA
Dr Arthur Vasilaras	Urologist RPA
Dr Andre Lalak	Urologist CRGH
Dr Paul Sved	Urologist RPA
Dr Jeremy Fallot Dr Mark Broe	Urology Robotic Research Fellow
Ms Virginia Ip	Clinical Nurse Consultant RPA
Ms Beth Whittaker	Clinical Nurse Consultant CRGH
Mr Kevin Ancog	Prostate Cancer Specialist Nurse RPA
Research Team	
A/Prof Daniel Steffens	Director SOuRCe
Mr Sascha Karunaratne	Research Manager SOuRCe
Mr Nicholas Hirst	Robotic Research Officer SOuRCe
Ms Kate Alexander	Orthopaedic Research Officer SOuRCe
Ms Dana Georgevsky	Benign Gynaecology Senior Research Officer RPA
Ms Anna Disney Mr James Morkaya	Upper Gastrointestinal Research Officer SOuRCe
Ms Kadja Benicio Ms Olivia Fox Ms Kiera Taylor	Pelvic Exenteration Research Officer SOuRCe

4. Program Activity

4.1 Overview

Research is a core component of the comprehensive governance framework surrounding RAS at RPA. This approach determines that every patient being operated on robotically must be enrolled in a research study enabling a strong contribution to be made to the existing knowledge regarding the strengths, limitations, costs and benefits of RAS across a range of surgical procedures, as well as all procedure specific ethical requirements.

Currently there are five surgical specialties utilising the da Vinci Xi Surgical System at RPA including benign gynaecology, cardiothoracic, colorectal, upper gastrointestinal and urology. In addition, the Stryker MAKO Robotic System is being used by orthopaedics.

Overall, 985 RAS procedures have been performed at RPA with 119 of these being completed during the 2021/22 financial year, of these 65 were on the da Vinci Xi and 54 on the MAKO systems. This resulted in an average monthly RAS caseload of approximately 10 patients (**Figure 2 & 3**).

Figure 2. Robotic surgical activities from August 2016 to June 2022 (N=985)

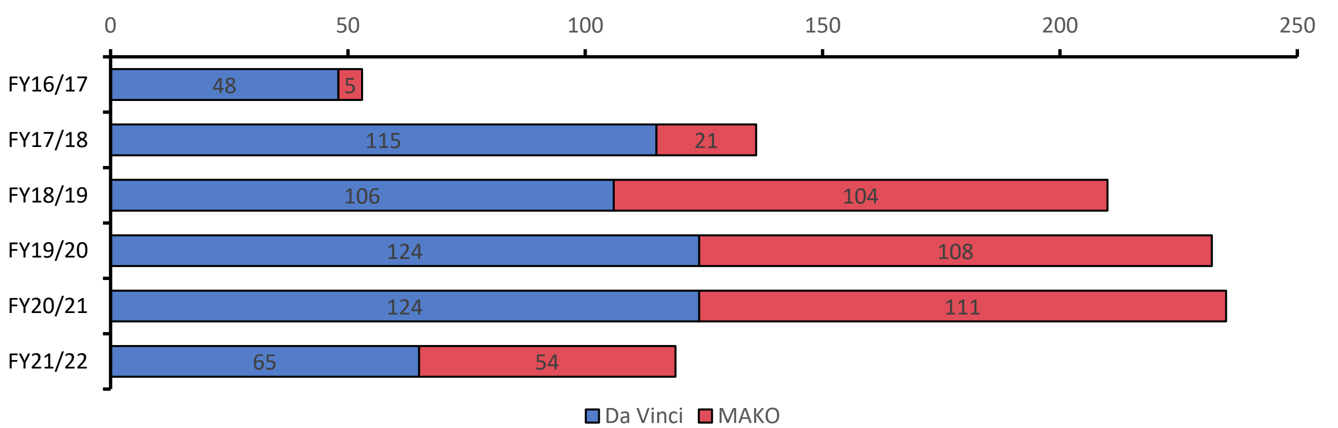
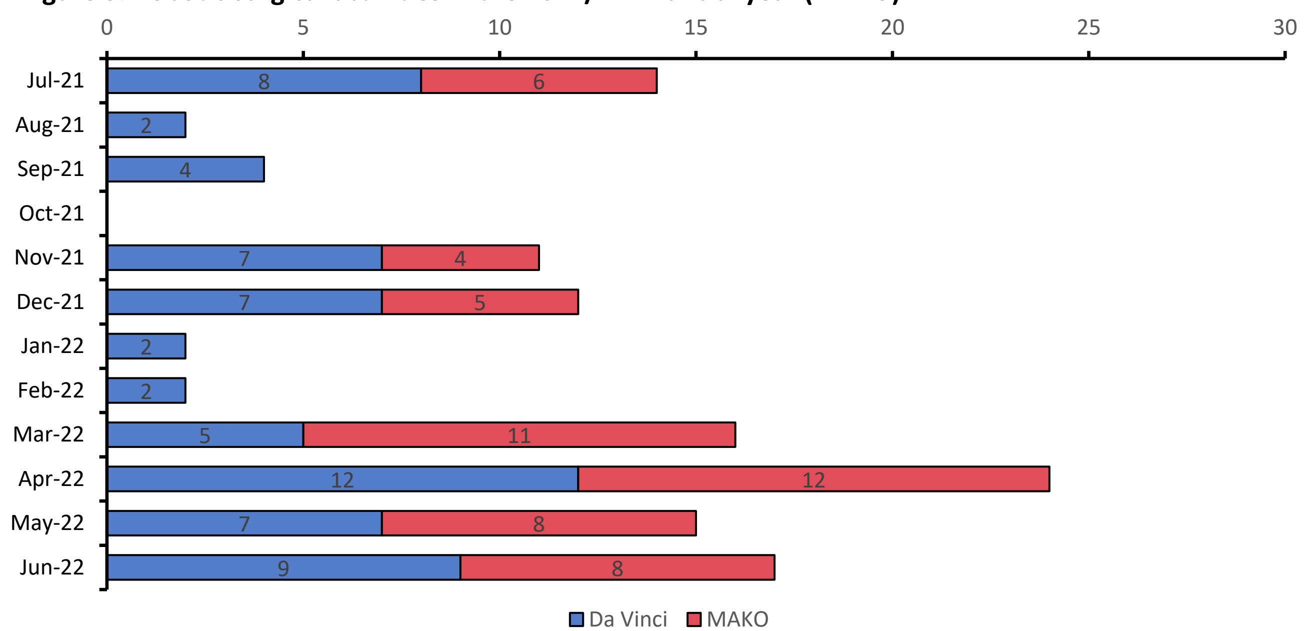
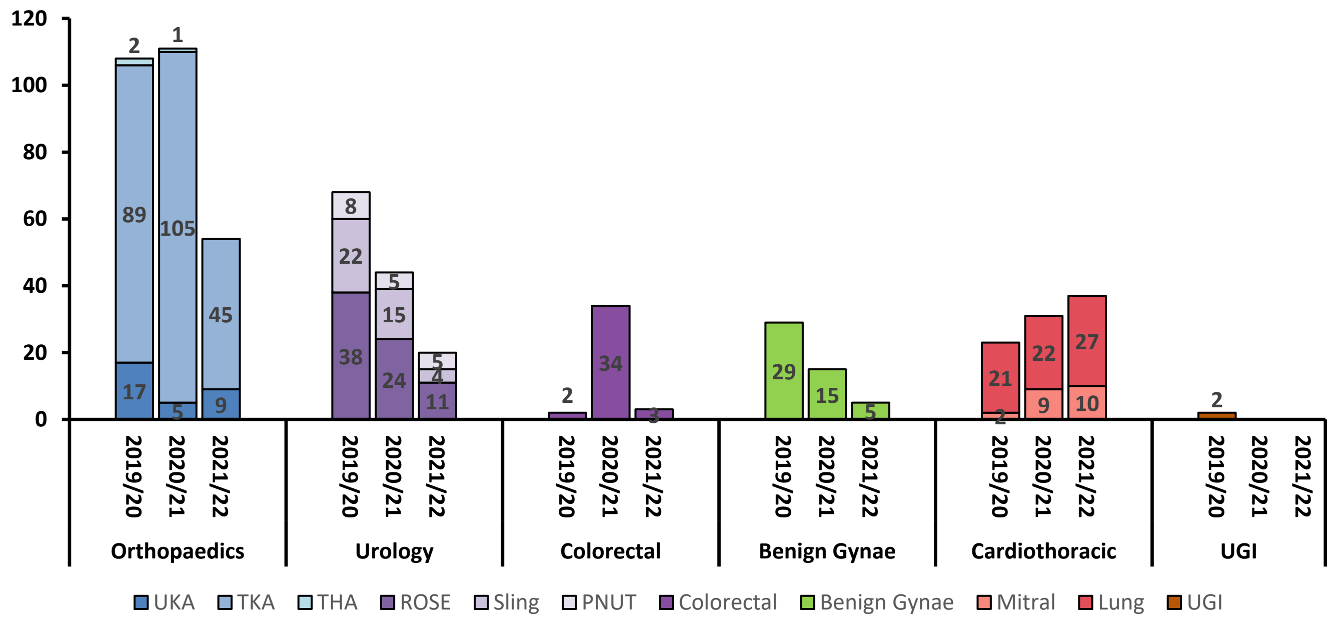


Figure 3. Robotic surgical activities in the 2021/22 financial year (N=119)



The impact of COVID-19 was evident across the last three financial years. Urology and benign gynaecology specialties have experienced a significant reduction on their caseload from the 2019/20 to the 2021/22 financial years. Colorectal robotic surgery was most impacted in the 2019/20 and 2021/22 financial years, whilst Cardiothoracic robotic surgery steadily increased recruitment. In the 2021/22 financial year, orthopaedics performed the greatest number of robotic cases (n=54), followed by cardiothoracic (n=37), and urology (n=20) (**Figure 4**).

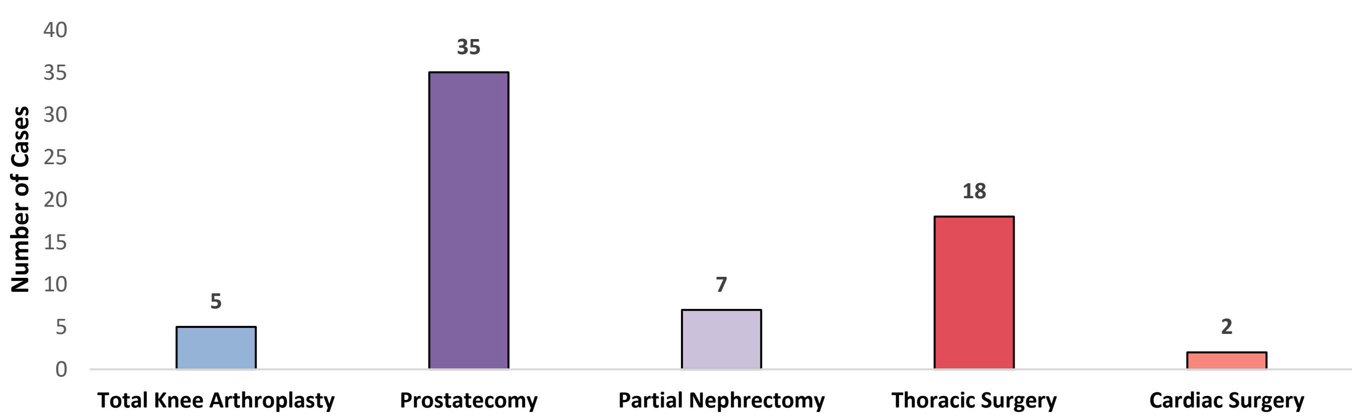
Figure 4. Robotic surgical activity by surgical speciality



4.2 Collaborative Care Agreements

Due to the significant disruptions to the robotic surgical program at RPA Hospital resulting from COVID-19 restrictions across the hospital and district, collaborative care agreements (CCA) were implemented to allow public patients from RPA to undergo RAS at other private hospitals. Under CCAs, a total of 67 RAS cases were performed offsite at six hospitals across Sydney within the 2021/22 including 35 robotic-assisted prostatectomies, seven robotic-assisted partial nephrectomies, 18 robotic-assisted thoracic surgeries, two robotic-assisted cardiac surgeries and five robotic-assisted total knee arthroplasties (**Figure 5**).

Figure 5. Robotic Assisted Surgeries Under Collaborative Care Agreements (FY21/22)



4.3 da Vinci Xi Surgical System

The da Vinci Xi Surgical System was purchased in December 2015 with the first ethics approval obtained and first case performed by cardiothoracic in February and August 2016, respectively. The five active specialties using the da Vinci system are currently recruiting patients to 11 different research studies or databases.

Overall, 582 procedures have been performed at RPA using the da Vinci Xi Surgical System, with 65 undertaken in 2021/22 (**Figure 2**).

4.3.1 Cardiothoracic

There are currently two active cardiothoracic robotic research studies including:

- ***Robotic-Assisted Lung Resection (RoboLung)***
- ***Robotic-Assisted Mitral Valve (RoboMitral)***

Overall, 128 patients have received cardiothoracic robotic surgery at RPA, with 37 of these procedures performed in 2021/22. The initial RoboCab study (Robotic Assisted Artery Bypass Grafting) recruited a total of 31 patients and has now been completed.

Description of research studies/databases

The two active cardiothoracic robotic research projects are described in **Table 2A-B**.

Table 2A. Description of the RoboLung Database	
Study Title:	Robotic-Assisted Lung Resection (RoboLung)
HREC and SSA ref Number:	X18-0014, HREC/18/RPAH/12 and SSA/18/RPAH/148
General Aim:	Collect information about patients undergoing robotic-assisted lung resection
Design:	Prospective database
Main endpoints:	• Assess patient outcomes and recovery • Provide quality control within our department • Set a national Standard for outcomes
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

Table 2B. Description of the RoboMitral Database	
Study Title:	Robotic-Assisted Mitral Valve Surgery (RoboMitral)
HREC and SSA ref Number:	X18-0294, HREC/18/RPAH/401 and 2019/STE16330
General Aim:	Collect information about patients undergoing robotic-assisted mitral valve
Design:	Prospective database
Main endpoints:	• Assess patient outcomes and recovery • Quality of life and health utilisation
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

Characteristics of the study population

The characteristics of the participants included in the RoboLung and RoboMitral projects are described on **Table 3**. Overall, majority of participants included were Male (52%) with a mean age of 60.5 years. The majority of robotic procedures were elective (83%) and included public patients (92%).

Table 3. Characteristics of the study population						
Variables	RoboLung		RoboMitral		Overall Cardiothoracic	
	Overall (N=76)	2021/22 (N=27)	Overall (N=21)	2021/22 (N=10)	Overall (N=128*)	2021/22 (N=37)
Gender, *Male*	29 (38%)	11 (41%)	12 (57%)	7 (70%)	66 (52%)	18 (49%)
Age (years)	61.9 ± 16.2	63.2 ± 15.5	53.7 ± 14.7	51.7 ± 16.9	60.5 ± 14.9	60.1 ± 16.5
Insurance, *Public*	71 (93%)	25 (93%)	21 (100%)	10 (100%)	118 (92%)	35 (95%)
Country of Birth, *Australia*	44 (58%)	18 (67%)	13 (62%)	8 (80%)	71 (56%)	26 (70%)
Admission, *Elective*	70 (92%)	22 (82%)	20 (95%)	10 (100%)	106 (83%)	32 (87%)

**Includes patients from the initial RoboCab study. Data presented as N (%) or mean ± SD.*

Operating time and length of stay

The overall operating time was approximately 5.4 hours, with patients in the RoboLung study staying in hospital for 5.0 days and patients in the RoboMitral study staying in for 7.0 days. **Table 4** presents this data for all patients undergoing cardiothoracic robotic surgery.

Table 4. Operating time and length of stay for patients undergoing cardiothoracic robotic surgery						
Variables	RoboLung		RoboMitral		Overall Cardiothoracic	
	Overall (N=76)	2021/22 (N=27)	Overall (N=21)	2021/22 (N=10)	Overall (N=128)	2021/22 (N=37)
Console time (hours)	1.6 ± 1.1	2.1 ± 1.1	2.4 ± 0.6	2.4 ± 0.7	1.9 ± 1.0	2.2 ± 1.0
Docking Time (mins)	7.0 ± 5.2	5.7 ± 4.5	7.7 ± 3.1	8.2 ± 3.1	8.2 ± 1.0	6.4 ± 4.5
Surgery Time (hours)	2.9 ± 1.3	3.1 ± 1.2	4.7 ± 0.7	4.7 ± 0.8	3.8 ± 1.7	3.5 ± 1.3
Operating time (hours)	4.1 ± 1.4	4.3 ± 1.2	6.9 ± 0.8	7.0 ± 0.8	5.4 ± 2.0	5.0 ± 1.6
Length of stay (days)	5.0 ± 6.1	5.5 ± 3.6	7.0 ± 2.8	6.4 ± 3.0	5.8 ± 5.2	5.8 ± 3.4

Data presented as mean ± SD.

Patient reported outcomes

All patients treated within the surgical robotics program are requested to report their outcomes through a range of questionnaires that cover quality of life (using the SF-36v2 survey), work and care responsibilities, health service utilization, assistance required at home, financial issues and paid/unpaid activities.

Overall, the completion rate was from 86% at the pre-operative period to 56% at six months post-operative. The completion rate for cardiothoracic robotic projects is outlined on **Table 5**.

Table 5. Patient Reported Outcomes						
Variables	RoboLung		RoboMitral		Overall Cardiothoracic*	
	Due	Received	Due	Received	Due	Received
Pre-Operative	76	60 (79%)	21	19 (91%)	128	110 (86%)
6 Weeks Post-Operative	72	36 (50%)	19	13 (68%)	122	73 (60%)
6 Months Post-Operative	61	33 (54%)	16	10 (63%)	108	61 (56%)

**Includes patients from the initial RoboCab study. Data presented as N (%).*

4.3.2 Colorectal

The colorectal department received ethics approval for their RAS study titled ***Robotic-Assisted Colorectal Surgery: The Creation of a Prospective Database (RACS-Data)*** in March 2017 and performed the first case in November 2017.

Overall, colorectal has completed 63 RAS cases with three of these undertaken in 2021/22. Currently there are three colorectal surgeons utilising the Da Vinci Xi robot. In 2020/21, the colorectal team with the support from the Robotics Working Group party amended the current protocol to expand the indications to allow for further procedures to be included. The number of colorectal RAS in 2021/22 was significantly reduced due to COVID-19 restrictions.

Description of research studies/databases

The description of the colorectal robotic databse is outlined in **Table 6**.

Table 6. Description of the Robotic Assisted Colorectal Surgery (RACS) Database	
Study Title:	Robotic-Assisted Colorectal Surgery: The Creation of a Prospective Database (RACS-Data)
HREC and SSA ref Number:	X17-0093, HREC/17/RPAH/137 and SSA/17/RPAH/279
General Aim:	To analyse and compare short term surgical outcomes
Design:	Prospective database
Main endpoints:	• To create a database of patient characteristics and in-hospital outcomes of patients suitable for robotic assisted rectal resection • Analyse and compare short term in-hospital outcomes
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

Characteristics of the study population

Overall, most participants undergoing colorectal RAS were males (57%) with a mean age of 61.3 years. Most procedures were elective (98%) with the majority being public patients (76%). A detailed description of the colorectal RAS population is outlined in **Table 7**.

Table 7. Characteristics of the study population

Variables	**Overall (N=63)**	**2021/22 (N=3)**
Gender, *Male*	36 (57%)	3 (100%)
Age (years)	61.3 ± 14.4	53.3 ± 3.2
Insurance, *Public*	48 (76%)	3 (100%)
Country of Birth, *Australia*	29 (46%)	3 (100%)
Admission, *Elective*	62 (98%)	3 (100%)

Data presented as N (%) or mean ± SD.

Operating time and length of stay

Of the robotic colorectal surgeries performed in 2021/22, the mean console time was 3.0 hours, docking time was 12.3 minutes, surgical time 5.2 hours, and total operating time was 6.8 hours. The mean length of hospital stay was 5.6 days (**Table 8**).

Table 8. Operating time and length of stay for patients undergoing robotic rectal resection		
Variables	**Overall (N=63)**	**2021/22 (N=3)**
Console time (hours)	3.6 ± 1.4	3.0 ± 0.3
Docking Time (mins)	11.4 ± 9.7	12.3 ± 15.4
Surgery Time (hours)	6.0 ± 1.6	5.2 ± 0.6
Operating time (hours)	7.6 ± 1.8	6.8 ± 0.7
Length of stay (days)	9.6 ± 14.3	5.6 ± 3.8

Data presented as mean ± SD.

Patient reported outcomes

The rate of data collected from patients regarding their reported outcomes was 98% preoperatively, decreasing to 82% at 6 weeks post-operatively and to 67% at 6 months post-operatively (**Table 9**).

Table 9. Patient Reported Outcomes		
Variables	**Due**	**Received**
Pre-Operative	63	62 (98%)
6 Weeks Post-Operative	62	51 (82%)
6 Months Post-Operative	60	40 (67%)

Data presented as N (%).

4.3.3 Benign Gynaecology

Benign gynaecology receievd ethics approval in May 2016 and site specific approval in May 2017, with the first RAS case being performed in October 2017. To date, 95 benign gynaecological procedures have been performed at RPA by three surgeons with five of these being undertaken in 2021/22.

Due to issues identified by the Data, Safety and Monitoring Board (DSMB) during their initial 30 case review, which included lack of protocol adherence and data collection, the protocol was temporarily suspended in June 2018 until the issues identified could be rectified. Following a number of steps that were put in place, the protocol was officially recommenced in April 2019. In June 2020 the team conducted their one year post-suspension review and the Robotics Working Group and the Ethics Committee were satisfied with the program's progress to date.

On 6 September 2021, the benign gynaecology robotic team amended the current research protocol. This extended the data collection for patients undergoing robotic hysterectomy, endometriosis resection and pelvic organ prolapse. The team is also working on the first benign gynaecology trial for the department.

Description of research studies/databases

The description of the benign gynaecology database is presented in **Table 10**.

Table 10. Description of the RSBG study	
Study Title:	Robotic surgery for benign gynaecology: the initial experience from an Australian tertiary unit (RSBG)
HREC and SSA ref Number:	X16-0223, HREC/16/RPAH/274 and SSA/17/RPAH/219
General Aim:	To determine the surgical outcomes, complications and costs of the introduction of robotic surgery for benign gynaecology
Design:	Prospective observational study
Main endpoints:	• Clinical safety • Learning curve • Quality of life • Health economics • Cost effectiveness
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

Characteristics of the study population

Overall, the mean age of the female patients was 39.9 years with most being from Australia (60%). **Table 11** describes the characteristics of the patients that underwent RAS within benign gynaecology.

Table 11. Characteristics of the study population

Variables	Overall (N=95)	2021/22 (N=5)
Gender, *Male*	--	--
Age (years)	39.9 ± 11.3	43.2 ± 11.3
Insurance, *Public*	56 (59%)	5 (100%)
Country of Birth, *Australia*	57 (60%)	4 (80%)
Admission, *Elective*	95 (100%)	5 (100%)

Data presented as N (%) or mean ± SD.

Operating time and length of stay

The overall operation time for patients was 3.3 hours with patients staying in hospital on average for 1.7 days. For the 2021/22 cohort, the mean length of hospital stay increased slightly to 3.0 days. **Table 12** outlines the surgical outcomes for all patients.

Table 12. Operating time and length of stay

Variables	Overall (N=95)	2021/22 (N=5)
Console time (hours)	1.6 ± 0.9	2.0 ± 0.4
Docking Time (mins)	7.4 ± 3.9	5.2 ± 1.5
Surgery Time (hours)	2.5 ± 1.1	3.1 ± 0.7
Operating time (hours)	3.3 ± 1.2	4.0 ± 0.6
Length of stay (days)	1.7 ± 1.4	3.0 ± 1.9

Data presented as mean ± SD.

Patient reported outcomes

Completion rate for the patient reported outcomes is outlined in **Table 13**. The follow-up rate was 97% pre-operatively, decreasing to 75% at 6 weeks and 71% at 6 months post-operatively.

Table 13. Patient Reported Outcomes		
Variables	**Due**	**Received**
Pre-Operative	95	92 (97%)
6 Weeks Post-Operative	94	70 (75%)
6 Months Post-Operative	92	65 (71%)

Data presented as N (%).

4.3.4 Urology

Urology was the second department to utilize the da Vinci Xi robot at RPA. The study received ethics approval in June 2016 and the first procedure was performed in October 2016. Overall, urology has performed 294 cases with 20 being undertaken in 2021/22. Currently there are five surgeons performing robotic radical prostatectomy and partial nephrectomy at RPA.

Urology has four active research studies including:

(i) ***Robotic and open surgery for prostate cancer: a prospective, multicentre, comparative study of functional and oncological outcomes (ROSE).***

(ii) ***Randomised study assessing urinary continence following robotic radical prostatectomy with or without an intraoperative retropubic vascularised fascial sling (ROBOSling).***

The ROBOSling trial was the first full-scale robotic randomised controlled trial initiated at RPA.

(iii) ***Early unclamping versus regular clamping in robot assisted partial nephrectomy: a multicenter, prospective, randomised controlled clinical trial looking at functional and oncological outcomes (PNUT).***

(iv) ***Randomised study assessing intracorporeal versus extracorporeal urinary diversion for patients undergoing robotic assisted cystectomy (UDIVERT).***

To date, 218 patients have been enrolled in the ROSE study, 52 the ROBOSling trial and 24 the PNUT trial at RPA. The UDIVERT trial received ethical approval, however has not recruited any participants to date.

Data Safety and Monitoring Board

On 4 March 2022, the DSMB, reviewed the progress of the PNUT study after 20 patients were recruited. Following a presentation by the urology team, the DSMB panel members, which included Prof David Gillatt from Macquarie University Hospital as the External Expert Reviewer, deemed the study safe and provided recommendations for the study to continue recruitment.

Description of research studies/databases

A description of the three urological studies is outlined within **Table 14A-D.**

Table 14A. Description of the ROSE study	
Study Title:	Robotic and open surgery for prostate cancer: a prospective, multicentre, comparative study of functional and oncological outcomes (ROSE)
HREC and SSA ref Number:	X16-0294, HREC/16/RPAH/377 and SSA/16/RPAH/565, SSA/16/CRGH/254
General Aim:	To assess pre-operative and post-operative oncological, urinary and sexual functional and quality of life outcomes following Robot-Assisted Radical Prostatectomy (RARP) compared to Open Radical Prostatectomy (ORP).
Design:	Prospective cohort study
Main endpoints:	• Oncological outcomes • Urinary and sexual function • Quality of life
Sample size:	562
Status:	Recruiting
Estimated Completion date:	December 2023

Table 14B. Description of the ROBOSling Trial	
Study Title:	Randomised study assessing urinary continence following robotic radical prostatectomy with or without an intraoperative retropubic vascularised fascial sling (ROBOSling)
HREC and SSA ref Number:	X17-0339, HREC/17/RPAH518 and SSA/18/RPAH/633
General Aim:	To determine if early and late post-operative continence is improved by performing a RoboSling procedure concurrently with RARP in men undergoing treatment for localised prostate cancer
Design:	Randomized controlled trial
Main endpoints:	Urinary continence at 3 months postoperative
Sample size:	120
Status:	Recruiting
Estimated Completion date:	December 2023

Table 14C. Description of the PNUT Trial	
Study Title:	Early unclamping versus regular clamping in robot assisted partial nephrectomy: a multicenter, prospective, randomised controlled clinical trial looking at functional and oncological outcomes (PNUT)
HREC and SSA ref Number:	X18-0389, HREC/18/RPAH/547 and SSA/19/RPAH/50
General Aim:	To assess the change in differential kidney function as demonstrated by DTPA nuclear renography and change in estimated glomerular filtration rate (eGFR) using early unclamping compared to regular clamping in RAPN
Design:	Randomised controlled trial
Main endpoints:	Postoperative functional kidney recovery
Sample size:	118
Status:	Recruiting
Estimated Completion date:	December 2023

Table 14D. Description of the UDIVERT Trial	
Study Title:	Randomised study assessing intracorporeal versus extracorporeal urinary diversion for patients undergoing robotic assisted cystectomy (UDIVERT)
HREC and SSA ref Number:	X18-0389, HREC/18/RPAH/547 and SSA/19/RPAH/50
General Aim:	To determine if Robotic intracorporeal urinary diversion has superior outcomes compared to patients undergoing extracorporeal urinary diversion in terms of length of stay (LOS).
Design:	Randomised controlled trial
Main endpoints:	Difference in mean length of stay (LOS) of patients following robotic assisted cystectomy with intracorporeal or extracorporeal urinary diversion.
Sample size:	72
Status:	Commencing recruitment
Estimated Completion date:	December 2024

Characteristics of the study population

Overall, the mean age of the male patients was 63.5 years with most being born overseas (65%). **Table 15** describes the characteristics of the patients that underwent RAS within urology.

Table 15. Characteristics of the study population

Variables	ROSE		PNUT		ROBOSLING		Overall Urology	
	Overall (N=218)	**2021/22 (N=11)**	**Overall (N=24)**	**2021/22 (N=5)**	**Overall (N=52)**	**2021/22 (N=4)**	**Overall (N=294)**	**2021/22 (N=20)**
Gender, *Male*	218 (100%)	11 (100%)	17 (71%)	5 (100%)	52 (100%)	4 (100%)	287 (98%)	20 (100%)
Age (years)	64.2 ± 7.6	62.3 ± 6.6	60.8 ± 12.4	54.4 ± 15.1	62.0 ± 8.5	64.3 ± 11.9	63.5 ± 8.3	60.7 ± 10.4
Insurance, *Public*	188 (86%)	11 (100%)	24 (100%)	5 (100%)	48 (92%)	3 (75%)	260 (88%)	19 (95%)
Country of Birth, *Australia*	64 (30%)	6 (55%)	11 (46%)	3 (60%)	27 (52%)	3 (75%)	102 (35%)	12 (60%)
Admission, *Elective*	218 (100%)	11 (100%)	24 (100%)	5 (100%)	52 (100%)	4 (100%)	294 (100%)	20 (100%)

Data presented as N (%) or mean ± SD.

Operating time and length of stay

Overall robotic docking time was 5.9 minutes with a total operation time of 5.2 hours. Patients undergoing robotic radical prostatectomy stay in hospital for 2.3 days on average, compared to 4.5 days for patients undergoing partial nephrectomy and 2.9 days for radical prostatectomy in the ROBOSling RCT study (**Table 16**).

Table 16. Operating time and length of stay for patients undergoing urological robotic surgery

Variables	ROSE		PNUT		ROBOSLING		Overall Urology	
	Overall (N=218)	**2021/22 (N=11)**	**Overall (N=24)**	**2021/22 (N=5)**	**Overall (N=52)**	**2021/22 (N=4)**	**Overall (N=294)**	**2021/22 (N=20)**
Console time (hours)	3.1 ± 0.6	3.5 ± 0.3	2.4 ± 0.8	3.2 ± 1.3	3.1 ± 0.8	3.7 ± 0.5	3.0 ± 0.7	3.5 ± 0.7
Docking Time (mins)	6.1 ± 4.5	4.2 ± 2.1	6.0 ± 2.8	5.6 ± 1.5	5.0 ± 2.9	5.0 ± 2.2	5.9 ± 4.2	4.7 ± 2.0
Surgery Time (hours)	4.1 ± 0.6	4.4 ± 0.4	3.5 ± 0.8	4.1 ± 0.8	4.1 ± 0.8	4.5 ± 0.6	4.0 ± 0.7	4.4 ± 0.6
Operating time (hours)	5.2 ± 0.7	5.5 ± 0.5	4.9 ± 0.7	5.1 ± 0.9	5.2 ± 0.9	5.5 ± 0.5	5.2 ± 0.7	5.4 ± 0.6
Length of stay (days)	2.3 ± 2.1	4.6 ± 4.4	4.5 ± 4.1	4.2 ± 1.6	2.9 ± 2.3	2.6 ± 1.0	2.6 ± 2.4	4.1 ± 3.4

Data presented as mean ± SD.

Patient reported outcomes

Completion rate for the patient reported outcomes is outlined in **Table 17**. The follow-up rate overall was 94% pre-operatively, decreasing to 80% at 6 weeks and 70% at 6 months post-operatively.

Table 17. Patient Reported Outcomes								
Variables	ROSE		PNUT		ROBOSLING		Overall Urology	
	Due	Received	Due	Received	Due	Received	Due	Received
Pre-Operative	218	204 (94%)	24	22 (92%)	52	51 (98%)	294	277 (94%)
6 Weeks Post-Operative	218	174 (80%)	23	14 (61%)	50	44 (88%)	291	232 (80%)
6 Months Post-Operative	213	144 (68%)	20	15 (75%)	50	39 (78%)	283	198 (70%)

Data presented as N (%).

4.3.5 Upper Gastrointestinal (UGI)

The UGI department received ethics and site specific approval in November 2017, with the first RAS case being performed in December 2019. To date, two RAS UGI procedures have been performed at RPA by one surgeon. No robotic upper gastrointestinal procedures were performed in the 2021/22 financial year. The department is currentlty working on a new research project that will investigate outcomes following adbominal hernia repair, and is expected to start in the 2022/23 financial year.

Description of research studies/databases

The description of the Upper Gastrointestinal Series database is presented in **Table 18**.

Table 18. Description of the UGI study	
Study Title:	Robotic Hepatobiliary and oesophagogastric surgery: A prospective database of clinical and oncological outcomes (RUGI)
HREC and SSA ref Number:	X17-0131, HREC/17/RPAH/193 and SSA/17/RPAH/628
General Aim:	To determine clinical an oncological outcome, support quality improvement activities and feasibility.
Design:	Prospective observational study
Main endpoints:	• Clinical safety • Learning curve • Cost effectiveness
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

The upper gastrointestinal robotic team is currently working on a new research protocol to investigate outcomes following robotic-assisted repair of incisional hernias after liver transplantation. This study is expected to commence late 2022.

4.4 MAKO Robotic System

The MAKO Robotic System was purchased in December 2016 with ethics approval received in February and the first case performed in April 2017. At the initial stage, the MAKO robot was only able to perform unicompartmental knee arthroplasty (UKA) and total hip arthroplasty (THA), with total knee arthroplasty (TKA) starting in October 2018 after the purchase of the MAKO's specific software program. Currently there are six orthopaedic surgeons utilizing the MAKO robot at the Institute of Rheumatology & Orthopaedics (IRO) based at RPA.

4.4.1 Orthopaedics

A total of 400 knee arthroplasties and three hip arthroplasties have been performed using the MAKO robot with 54 knee arthroplasties performed in 2021/22. There were no hip arthroplasties performed in 2021/22. Overall, 328 (81%) were total knee arthroplasties, 72 (18%) were unicompartmental knee arthroplasties and three (1%) were total hip arthroplasties.

Currently the orthopaedic department has two main databases that collects patient characteristics, surgical outcomes (***Lower Limb Robotic Arthroplasty Database [LOAD]***) and patient-reported outcomes (***Patient Reported Outcomes in Lower Limb Robotic Arthroplasty [PRO-LOAD]***).

Data Safety and Monitoring Board

In line with the protocol, a fourth DSMB review for use of the MAKO robot was undertaken virtually on 7 February 2022. The DSMB reviewed 349 (TKA=283, UKA/PFA=63, THA=3) patients of which 111 (TKA=105, UKA/PFA=5, THA=1) were performed in 2020/21. The DSMB panel, which included Dr David Dickison from the Mater Hospital as the External Expert Reviewer, recommended the continuation of program with no significant alterations.

Description of research studies/databases

A description of the LOAD and PRO-LOAD databases are outlined in **Tables 22A-B**. The PRO-LOAD database commenced in late 2018, therefore patient reported outcomes of the initial 31 patients that underwent unicompartmental knee arthroplasty are not reported.

Table 22A. Description of the LOAD Database	
Study Title:	Lower Limb Arthroplasty Database (LOAD)
HREC and SSA ref Number:	2019/ETH07354 & 2019/STE08052
General Aim:	To collate clinical information following lower limb arthroplasty procedures
Design:	Prospective database
Main endpoints:	Surgical outcomes
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

Table 22B. Description of the PRO-LOAD Database	
Study Title:	Patient reported outcomes in lower limb robotic arthroplasty: A prospective cohort study database (PRO-LOAD)
HREC and SSA ref Number:	2019/ETH06539 & 2019/STE08053
General Aim:	To evaluate patient reported outcomes following lower limb robotic arthroplasty procedures.
Design:	Prospective database
Main endpoints:	Patient reported outcomes
Sample size:	Ongoing
Status:	Recruiting
Estimated Completion date:	Ongoing

Characteristics of the study population

Overall, most of the patients were female (58%) presenting with a mean age of 67 years. All procedures were elective with the majority being public patients (80%). A detailed description of the orthopaedic RAS population is outlined in **Table 23**.

Table 23. Characteristics of the study population

Variables	TKA		UKA		THA		Overall Orthopaedic	
	Overall (N=328)	**2021/22 (N=45)**	**Overall (N=72)**	**2021/22 (N=9)**	**Overall (N=3)**	**2021/22 (N=0)**	**Overall (N=403)**	**2021/22 (N=54)**
Gender, *Male*	140 (43%)	23 (51%)	30 (42%)	5 (56%)	0 (0%)	-	170 (42%)	28 (52%)
Age (years)	67.6 ± 9.2	66.2 ± 8.2	64.0 ± 10.1	65.6 ± 13.2	43.4 ± 2.8	-	66.8 ± 9.7	67.1 ± 9.7
Insurance, *Public*	270 (82%)	35 (78%)	53 (74%)	8 (89%)	2 (67%)	-	323 (80%)	43 (79%)
Country of Birth, *Australia*	152 (46%)	25 (56%)	35 (49%)	3 (33%)	1 (33%)	-	188 (47%)	28 (52%)
Admission, *Elective*	328 (100%)	45 (100%)	72 (100%)	9 (100%)	3 (100%)	-	403 (100%)	54 (100%)

Data presented as N (%) or mean ± SD. TKA = Total Knee Arthroplasty, UKA = Unicompartmental Knee Arthroplasty, THA = Total Hip Arthroplasty.

Operating time and length of stay

The mean operating time was 2.1 hours for patients that underwent total knee arthroplasty, 1.7 hours for patients undergoing UKA and 2.6 hours for patients undergoing THA. Patients that underwent THA stayed longer in hospital (mean of 6.4 days) than patients that underwent UKA (mean of 3.6 days). No conversions to conventional arthroplasty occurred and there were no unplanned returns to theatre due to issues with prosthesis implantation though the reporting period (**Table 24**).

Table 24. Operating time and length of stay

Variables	TKA		UKA		THA		Overall Orthopaedic	
	Overall (N=328)	**2020/21 (N=45)**	**Overall (N=72)**	**2020/21 (N=9)**	**Overall (N=3)**	**2020/21 (N=0)**	**Overall (N=403)**	**2020/21 (N=54)**
Operating time (hours)	2.1 ± 0.7	2.0 ± 0.7	1.7 ± 0.3	1.4 ± 0.3	2.6 ± 0.2	-	2.0 ± 0.7	1.9 ± 0.7
Length of stay (days)	5.4 ± 2.5	5.1 ± 2.7	3.6 ± 1.1	3.0 ± 1.5	6.4 ± 0.7	-	5.1 ± 2.4	4.8 ± 2.6
Return to theatre	2 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	-	2 (1%)	0 (0%)

Data presented as N (%) or mean ± SD. TKA = Total Knee Arthroplasty, UKA = Unicompartmental Knee Arthroplasty, THA = Total Hip Arthroplasty.

Patient reported outcomes

Overall, most patients completed their patient reported outcome questionnaires. With completion rates ranging from 99% (preoperatively) to 69% (6 month post-operatively) (**Table 25**).

Table 25. Patient Reported Outcomes								
Variables	TKA		UKA		THA		Overall Orthopaedic	
	Overall (N=328)	**2021/22 (N=45)**	**Overall (N=41)***	**2020/21 (N=9)**	**Overall (N=3)**	**2021/22 (N=0)**	**Overall (N=372)***	**2021/22 (N=54)**
Pre-operative	326 (99%)	45 (100%)	41 (100%)	9 (100%)	3 (100%)	-	370 (99%)	54 (100%)
6 Weeks Post-Operative	225 (70%) Out of 320	27 (73%) Out of 37	35 (89%) Out of 39	7 (100%) Out of 7	1 (33%) Out of 3	-	276 (76%) Out of 363	34 (76%) Out of 45
6 Months Post-Operative	203 (69%) Out of 295	6 (46%) Out of 13	22 (65%) Out of 34	1 (50%) Out of 2	2 (67%) Out of 3	-	227 (69%) Out of 329	6 (40%) Out of 15

*Data presented as N (%). TKA = Total Knee Arthroplasty, UKA = Unicompartmental Knee Arthroplasty, THA = Total Hip Arthroplasty. *PRO-LOAD commenced in late 2018, as such n=31 UKA were not enrolled into patient-reported outcome follow-up.*

5. Robotics Research

5.1 Research in development

5.1.1. Colorectal

- Robotic multivisceral soft tissue extended resection – Investigate the safety, feasibility, postoperative morbidity and oncological outcomes of performing robotic-assisted multivisceral soft tissue extended resections.

5.1.2. Urology

- Australian experience – a case series of robotic-assisted simple prostatectomy

5.1.3. Upper Gastrointestinal

- Robotic-assisted repair of incisional hernia – investigating surgical and patient reported outcomes following robotic-assisted repair of incisional hernias after liver transplantation.

5.1.4. Orthopaedic

- Discharge to inpatient rehabilitation following robotic arthroplasty – evaluating the characteristics and outcomes of patients receiving robotic arthroplasty who are anecdotally less likely to require inpatient rehabilitation as compared to non-robotic cases.
- Investigating the most accurate registration technique for the MAKO navigation pins – evaluating the most exact and accurate technique for setting up the MAKO robot when positioning for implantation of a prosthesis.

5.1.5. Robotic Surgical Program

- Understanding surgical team learning curve in robotic-assisted surgery - investigate the learning curve of the multidisciplinary RAS team using time-based metrics within the operating theatre, and associations with surgical and patient reported outcomes.
- Impact of preoperative mental health on surgical and functional outcomes following robotic-assisted radical prostatectomy – exploring the impact of mental health on surgical, functional, quality of life and admission cost outcomes in patients following robotic-assisted radical prostatectomy via a mixed methods approach.

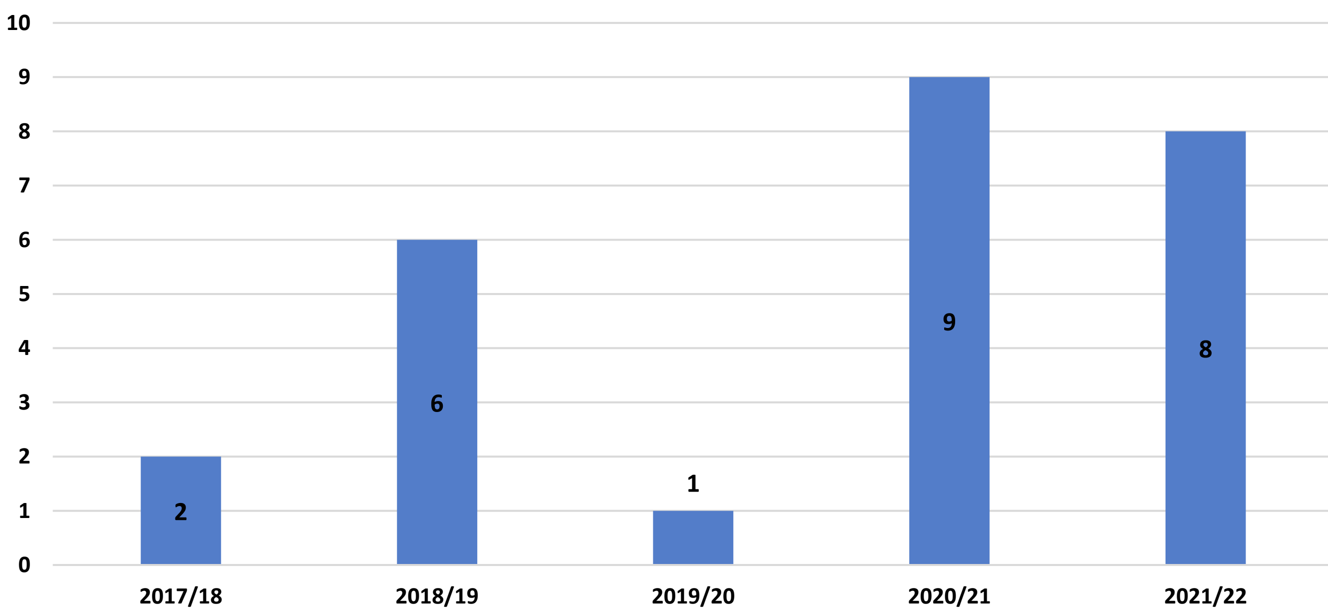
5.2 Research in progress (ethics completed)

- Robotic versus Laparoscopic Colon: a Randomized Trial (RoLaCaRT-1) – comparing the use of robotic surgery with laparoscopic surgery for the surgical treatment of right-sided colon cancer, the study will aim to determine whether the newer robotic technology will allow greater operative advantages which translate to improved rates of "successful surgery" and better patient-oriented clinical outcomes. Royal Prince Alfred Hospital is one site of this multicenter, international randomised control trial.
- Robotic-Assisted Radical Cystectomy (UDIVERT) – investigating if length of stay is improved by performing an intracorporeal urinary diversion procedure in patients undergoing Robotic-Assisted Radical Cystectomy.
- Robotic-assisted, kinematic alignment (RASKAL) – comparing individual and combined effectiveness of robotic-assisted and kinematic alignment in total knee arthroplasty when compared to computer-assisted surgery and mechanical alignment.
- Predictors of PROMs in Robotics – Evaluating the clinical and patient characteristics that lead to significant improvements in patients undergoing robotic arthroplasty.
- Cost of robotic-assisted knee arthroplasty – Cost analysis comparing in-hospital cost between computer-navigated arthroplasty and robotic-assisted knee arthroplasty.
- Quality of life outcomes for patients undergoing robotic-assisted surgery
- Cost of robotic-assisted surgery in the public sector: Hope or Hype?

5.3 Publications

Since the inception of the Surgical Robotics Program at RPA, a total of 26 peer-reviewed articles were published. Of these, eight articles were published within the 2021/22 financial year (**Figure 6**). In addition, a total of 12 conference presentations were completed in 2021/22 financial year.

Figure 6. Number of robotic surgical publications by financial year



5.3.1. List of publications

1. Park LS, Pan F, Steffens D, Young J, Hong J. Are Surgeons Working Smarter or Harder? A Systematic Review Comparing the Physical and Mental Demands of Robotic and Laparoscopic or Open Surgery. World Journal of Surgery, 2021. 45(7), 2066-2080. doi: 10.1007/s00268-021-06055-x.
2. Makary J, Van Diepen D, Arianayagam R, McClintock G, Fallot J, Leslie S and Thanigasalam R. The evolution of image guidance in robotic-assisted laparoscopic prostatectomy (RALP): a glimpse into the future. Journal of Robotic Surgery, 2021. Epub ahead of print. DOI: 10.1007/s11701-021-01305-5
3. Elliott J, Shatrov J, Fritsch B, Parker D. Robotic-assisted knee arthroplasty: An evolution in progress. A concise review of the available systems and the data supporting them. Archives of Orthopaedic and Trauma Surgery, 2021. 141 (12), p2099-2117. doi: 10.1007/s00402-021-04134-1.
4. Shatrov J, Murphy GT, Duong J, Fritsch B. Robotic-assisted total knee arthroplasty with the OMNIBot platform: A review of the principles of use and outcomes. Archives of Orthopaedic and Trauma Surgery, 2021. 141 (12), p2087-2096. DOI: 10.1007/s00402-021-04173-8.
5. McClintock G, Fallot J, Ahmadi N, Thanigasalam R, Trompf L, and Leslie S. Occult retained needle in an AirSeal port during robotic radical cystectomy. ANZ J Surg. 2021; 91(10). E680-E681.
6. Makary J, McClintock G, Fallot J, Broe M, Ahmadi N, Leslie S and Thanigasalam R. Video guide of robotic assisted laparoscopic prostatectomy post renal transplant: Unique considerations. Urology Video Journal, 2022. DOI:10.1016/j.urolvj.2022.100169.
7. Steffens D, Karunaratne S, McBride K, Gupta S, Horsley M, Fritsch B. Implementation of robotic-assisted total knee arthroplasty in the public health system: A comparative cost analysis. International Orthopaedics, 2022. 46 (3), p481-488. DOI: 10.1007/s00264-021-05203-1.
8. MacDessi SJ, Wernecke GC, Bastiras D, Hooper T, Heath E, Lorimer M, Harris I; RASKAL Study Group Anthony Leong, Aziz Bhimani, Brett Fristch, Daniel Franks, Darren B Chen, David Parker, David Penn, Durga Bastiras, Emma Heath, George Kirsh, Gregory C Wernecke, Ian A Harris, John Limbers, Jonathan Mulford, Julian Yu, Maurice Guzman, Michelle Lorimer, Peter McEwen, Richard Boyle, Samuel J MacDessi, Tamara Hooper. Robotic-assisted surgery and kinematic alignment in total knee arthroplasty (RASKAL study): A protocol of a national registry-nested, multicentre, 2×2 factorial randomised trial assessing clinical, intraoperative, functional, radiographic and survivorship outcomes. BMJ Open, 2022. 12 (6), e051088. DOI: 10.1136/bmjopen-2021-051088.

5.4 Conference presentation and posters

1. McClintock G, Goolam A S, Perera D, Downey R, Leslie S, Woo H, Ferguson P, Ahmadi N. Primary and post-chemotherapy robotic retroperitoneal lymph node dissection for metastatic testicular cancer. Royal Australasian College of Surgeons Annual Scientific Congress, Melbourne, Australia, 10-14 May 2021.
2. Cooper MJW. Multispeciality robotic endometriosis surgery. Invited presentation. Sydney Robot Institute, Virtual Webinar, 16 July 2021.
3. Boyle, R., Franks, D., Guzman, M. Current technology in Orthopaedics and Tumour Surgery. What are we actually capable of doing now? Surgical Robotics and Innovation Summit 2021, Virtual Webinar, 16 July 2021.

4. Georgevsky D & Duncan R, Taylor R, Yang V, Marren A, Varol N, Buckley V, Cooper MJW. The initial experience of Robotic surgery for Benign Gynaecology at the Royal Prince Alfred Hospital. Australasian Gynaecological Endoscopy and Aurgery, Brisbane, Australia, 8 October 2021.
5. McBride K. How to set-up a public hospital robotic program: implementation and cost. Tripartite Colorectal Meeting, Auckland, New Zealand, Virtual Attendance, 23 Feb 2022.
6. Cao C. The advantages of robotic lung resection over VATS. Royal Australasian College of Surgeons Annual Scientific Congress, Virtual, 2-6 May 2022.
7. Broe M. Surgeon's robotic surgical training program: What can nurses learn from this training model? Sydney Robotics and Innovation Summit, Sydney Masonic Centre, Sydney, Australia, 17-18 June 2022.
8. Cao C. Robotic sleeve resection. Sydney Robotics and Innovation Summit, Sydney Masonic Centre, Sydney, Australia, 17-18 June 2022.
9. Cooper MJW. Multispecialty robotic endometriosis surgery. Sydney Robotics and Innovation Summit, Sydney Masonic Centre, Sydney, Australia, 17-18 June 2022.
10. Pillinger S. Robotic training centre and program at RPAH and RoLaCaRT. Sydney Robotics and Innovation Summit, Sydney Masonic Centre, Sydney, Australia, 17-18 June 2022.
11. Yan T. Robotic Mitral Repair: String, Ruler and Bulldog. Sydney Robotics and Innovation Summit, Sydney Masonic Centre, Sydney, Australia, 17-18 June 2022.
12. Kirk A. Robotic right radical nephrectomy with caval exploration. Society of Robotic Surgery, Video Abstract Presentation, Lake Buena Vista, United States of America, 30 June - 3 July 2022.

6. Credentialing

Credentialing is another core component of the comprehensive governance framework surrounding RAS at RPA. The procedures established for both senior and junior medical staff seeking to have surgical robotics included in their scope of practice have been well defined and ensures that all staff sufficiently satisfy the criteria for them to be safely and competently involved in the surgical robotics program.

6.1 Medical staff with approved scope of practice

As of June 2022, there were eight proctors, 20 senior medical staff credentialed, three senior medical staff with interim clinical privileges, five junior medical staff able to operate on the console and 11 junior medical staff able to assist at the bedside credentialed at RPA across the six specialties involved in the surgical robotics program. Full details of these staff are outlined in **Table 26.**

Table 26. List of senior and junior medical staff with approved surgical robotics scope of practice						
Staff Level	**Cardiothoracic**	**Urology**	**Gynaecology**	**Colorectal**	**Orthopaedics**	**Upper GI**
Proctors	**Tristan Yan** Feb-19 **Christopher Cao** Sep-20	**Scott Leslie** Apr-16 **Ruban Thanigasalam** Jul-16 **Andre Lalak** Feb-17	**Scott Leslie** Apr-16 **Trevor Tejada-Berges** Nov-16 **Vivian Yang** Jun-19	**Scott Leslie** Apr-16 **Peter Lee** Jul-20	(Not required)	**Scott Leslie** Apr-16
Senior medical staff	**Tristan Yan** Feb-19 **Christopher Cao** Mar-19	**Scott Leslie** Apr-16 **Ruban Thanigasalam** Jul-16 **Paul Sved** Oct-16 **Andre Lalak** Feb-17 **Arthur Vasilaras** Feb-18	**Trevor Tejada-Berges** Nov-16 **Vivian Yang** Oct-17 **Michael Cooper** Oct-17	**Kirk Austin** Dec-17 **Peter Lee** Feb-18 **Chris Byrne** Mar-19 **Nima Ahmadi** Jun-22	**Brett Fritsch** Mar-17 **Sanjeev Gupta** Jul-18 **Maurice Guzman** Feb-19 **Richard Boyle** Feb-19 **Mark Horsley** Feb-19	**Jerome Laurence** Dec-19
Senior medical staff - interim privileges					**Daniel Franks** Sep-19	**David Yeo** Jul-18 **David Martin** Feb-19
Junior medical staff – console under supervision		**Brayden March** Jun-21 **Mark Broe** Aug-21 **Ross Calopedos** Feb-22 **Marnique Basto** March-22		**Jean Wong** Dec-20		
Junior medical staff – assist at bedside	**Abraham Rizkalla** Dec-20 **Anthony Le** Oct-21 **Matheus Carelli** Oct-21	**David Habashy** Feb-20 **Sia Kim** Aug-20 **Jean O'Riordan** Feb-21	**Rebecca Taylor** Feb-21	**Jean Wong** Dec-20 **Belinda Errington** May-21 **Michelle Smigielski** Jun-21 **Alistair Escott** Jun-22		

7. Surgical and Robotics Training Institute (RTI)

7.1 Overview

The RPA Surgical and Robotics Training Institute (RTI) was established in March 2017 and is the only officially designated training facility for da Vinci robotic surgery in the southern hemisphere. A unique partnership was formed between SLHD, Device Technologies, Intuitive Surgical, and The University of Sydney to establish the facility bringing together clinical care, research, training and state of the art medical technology.

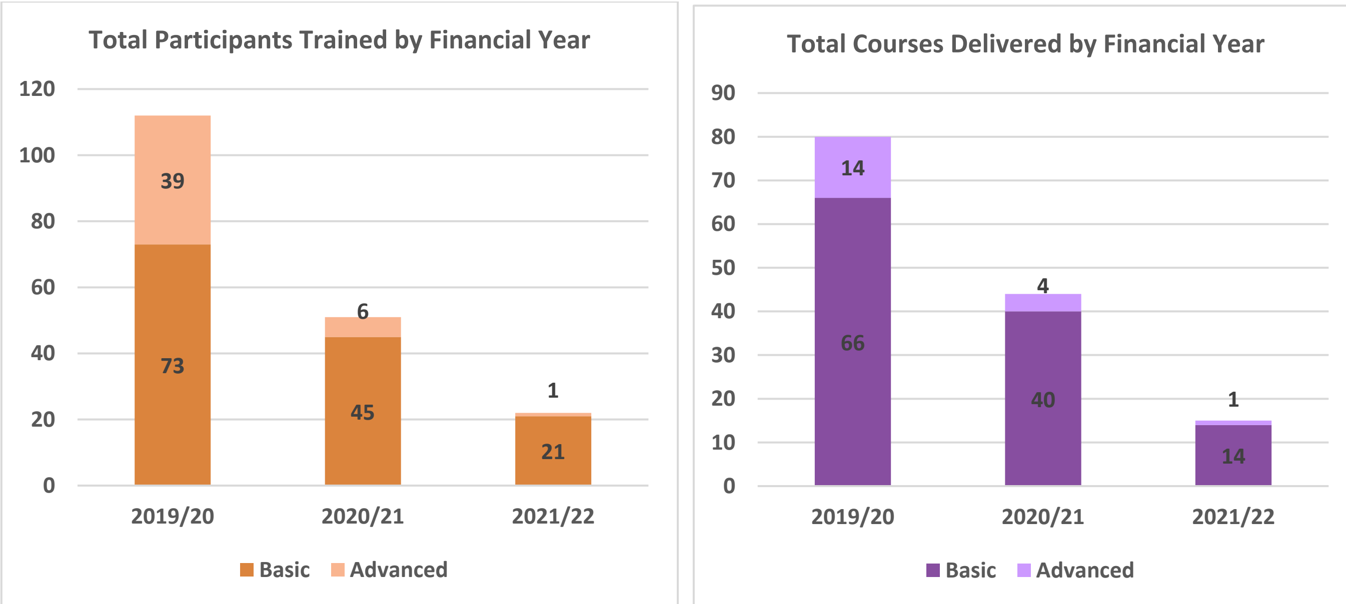
7.2 Training and Courses

In 2021/22 the RTI delivered 15 courses to a total of 22 participants trained including surgeons, surgical fellows and theatre nurses (**Table 24**). The majority of surgeons who trained at the RTI were from New South Wales, followed by interstate surgeons from Queensland and Victoria. Due to the COVID-19 pandemic and the subsequent travel restrictions set in place, no international surgeons attended and there were less interstate visitors overall compared to previous years.

Due to the ongoing workplace safety and travel restrictions set in place resulting from the COVID-19 pandemic and an unforeseen outbreak of Japanese encephalitis virus (JEV), limiting animal movement between March and June 2022, the opportunities to run face to face training courses were limited, therefore the number of courses offered and number of participants for the 2021/22 financial year were lower than the previous years (**Table 24** and **Figure 7)**.

Table 24. Overview of RTI training delivered	**Courses**	**Participants**
Basic Training (by specialty)		
Gynaecology	3	3
Colorectal	1	1
Cardiothoracic	3	3
Urology	0	0
Upper GI	0	0
General	0	0
ENT	0	0
Surgical Fellows	**7**	**14**
Sub-total basic training	**14**	**21**
Advanced Training		
Advanced Training	1	1
Introductory Course	0	0
Sub-total Advanced Training/Other	**1**	**1**
Grand Total	**15**	**22**

Figure 7. Total participants trained and courses delivered in the RTI by financial year.



Three main types of courses are run at the RTI: Basic Training, Advanced Training and Introductory Courses. Starting with the basic training course, this commences surgeons on the pathway to developing technical and clinical skill in using the da Vinci robot. Surgeons can then advance with a progressive, surgeon-led education series focused on clinical application, advanced techniques and procedure refinement. The surgeons leading these courses are often internationally recognised as leaders in their field.

Basic Training focuses on basic techniques including retraction of tissue in the abdominal, pelvic and thoracic cavity, dissection of vessels and lymph nodes, dissection of the uterine broad ligament, resection of the uterine body and lateral leaflets of the suspensory ligaments to surgically access the ureters. The training also includes basic tissue handling skills and suturing drills, organ to organ anastomosis, intercorporeal anastomosis as well as a simulated hernia repair

Advanced Training teaches participants the clinical application of the surgical robot to prepare for procedures. This includes the skills learned in basic training, procedure and system setup, patient positioning, surgical approach with the technology, clinical application for specific procedures and use of advanced instruments and technology during surgery.

Introductory Courses are designed to provide consultant level surgeons with an introductory educational experience with the surgical robot. The objective of these courses is to evaluate the feasibility and value of surgical robots in specialties where robots are not commonly used, such as gastrointestinal and thoracic surgical specialties and are not a substitute for the more involved Basic Training Course. Surgeons working in specialties where robot use is becoming usual practice such as gynaecology and urology would be required to complete a Basic Training Course

7.3 Animal Welfare

Animal welfare is the utmost priority of the RTI and a team of veterinary staff are dedicated to the care of all animals housed in the RTI. There were no incidents in the 2021/22 period.

8. Robotics Conferences

8.1 Surgical Robotics and Innovation Webinars

A number of webinars were hosted throughout July 2021 covering surgical robotics and innovation programs currently at RPA.

In collaboration with Device Technologies, Dr Scott Leslie and Associate Professor Ruban Thanigasalam hosted a webinar on complex multispecialty surgical robotic cases with a focus on collaboration in robotic surgery. The program featured presentations by Associate Professor Christopher Cao, Dr Kirk Austin, Dr Nariman Ahmadi, Associate Professor Charbel Sandroussi, Associate Professor Rhonda Farrell, Dr Echo Xie, Professor Michael Cooper, Dr Peter Lee, Associate Professor Jerome Laurence, Dr Charlotte van Kessel, Professor Tristan Yan and Dr Ranjan Arianayagam.

Associate Professor Payal Mukherjee hosted a webinar focusing on innovation translation in non-technical skills with presentations by Professor Gordon Wallace AO and Professor Jonathan Clark AM.

8.2 Surgical Robotics and Innovation Summit

The Surgical Robotics and Innovation Summit was held on Friday 17 and Saturday 18 June 2022 at the Sydney Masonic Centre (SMC) in Sydney. The two-day program included plenary sessions, and nine surgical specialty programs. The specialty programs included urology, colorectal, upper GI, cardiac, thoracic, head and neck, ENT, orthopaedics, benign gynaecology and gynae-oncology, and nursing. Across these specialties the Summit hosted 80 in person speakers and an additional 28 virtual speakers from across Australia and internationally including speakers from Belgium, Denmark, Italy, Korea, Netherlands, Singapore, UK, and USA.

The program was supported by industry sponsors including Device Technologies (platinum sponsor), Medtronic (gold sponsor), LifeHealthcare (silver sponsor), Stryker (silver sponsor) and an additional 13 bronze sponsors. Industry sponsors hosted an exhibition space which included several surgical robots on display during the summit. The program was a great success with over 500 delegates attending across the two days. The program was supported by 21 staff from the IAS and SOuRCe.

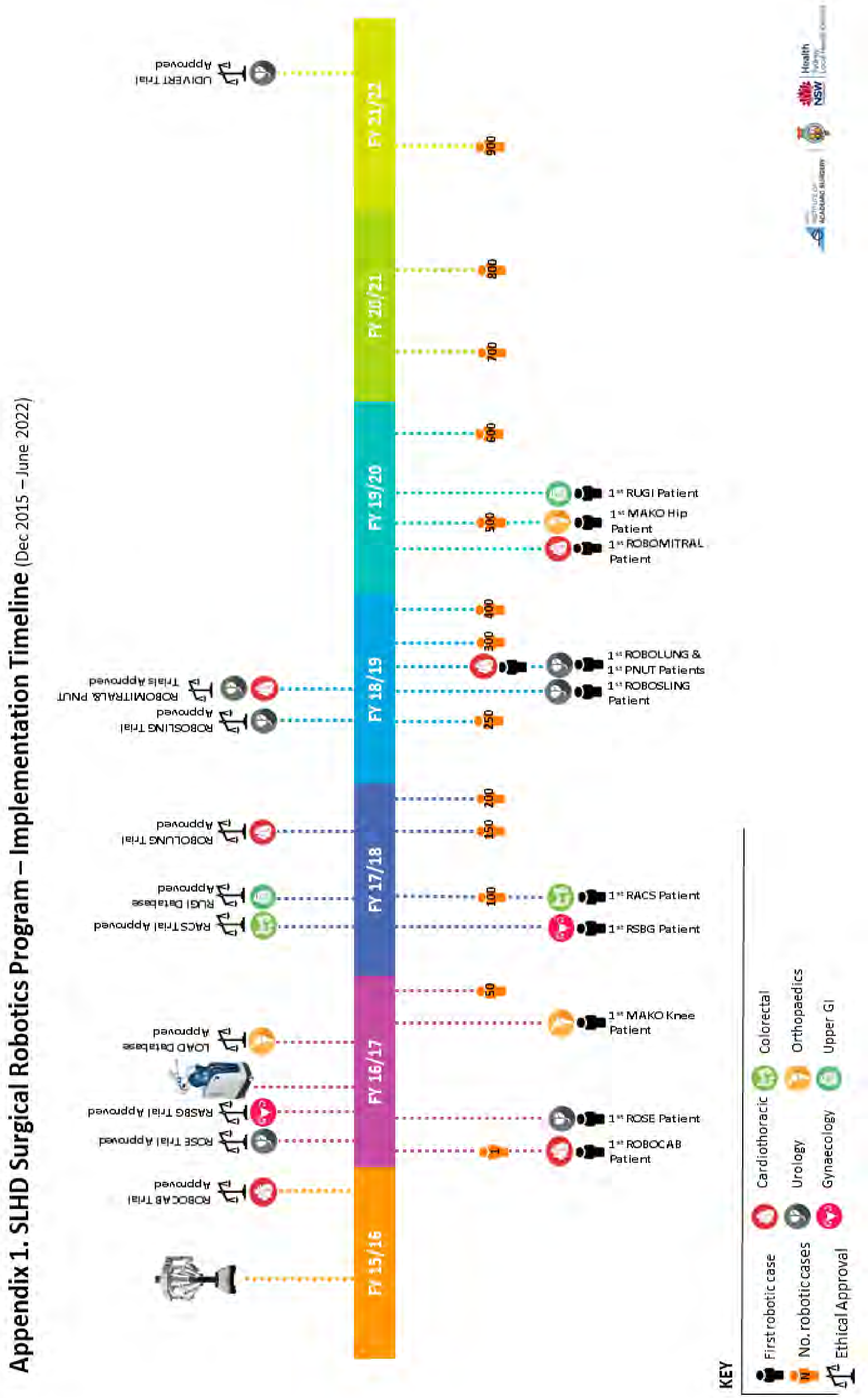
9. Conclusion

The surgical robotics program at RPA is one of the broadest multi-specialty public programs in Australia and is truly unique in that it is governed by a comprehensive research framework whereby every patient undergoing RAS is enrolled in a research study. The use of RAS on the campus is also strongly embedded in ongoing education and training. Despite the ongoing challenges posed by the COVID-19 pandemic, the program continued to progress throughout the 2021/22 period with all teams persevering within the evolving conditions.

Indeed, the success of the program is due to the vision and support of SLHD and RPA senior management, the dedication and commitment of the IAS, SOuRCe and surgical academics, and the skill of the many medical, nursing, allied health and research teams involved.

The development and future direction of the program will focus on the incorporation of further surgical procedures, publication of results and findings, and the opportunities for national and international collaboration. Certainly, the current program is a model for how other surgical technology can be introduced into the public sector.

10. Appendix



Appendix 1. SLHD Surgical Robotics Program – Implementation Timeline (Dec 2015 – June 2022)
FY 15/16
FY 16/17
FY 17/18
FY 18/19
FY 19/20
FY 20/21
FY 21/22
ROBOCAB Trial Approved
ROSE Trial Approved
RASBG Trial Approved
LOAD Database Approved
RACS Trial Approved
RUGI Database Approved
ROBOLUNG Trial Approved
ROBOSLING Trial Approved
ROBOMITRAL& PNUT Trials Approved
UDIVERT Trial Approved
1
1st ROBOCAB Patient
1st ROSE Patient
1st MAKO Knee Patient
50
1st RSBG Patient
100
1st RACS Patient
150
200
250
1st ROBOSLING Patient
1st ROBOLUNG & 1st PNUT Patients
300
400
1st ROBOMITRAL Patient
500
1st MAKO Hip Patient
1st RUGI Patient
600
700
800
900
KEY
First robotic case
No. robotic cases
Ethical Approval
Cardiothoracic
Urology
Gynaecology
Colorectal
Orthopaedics
Upper GI